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THE INVOLUNTARY NERVOUS SYSTEM IN RELATION TO ABDOMINAL DISEASE

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WE have recently been interested in a group of disturbances of certain of the hollow abdominal viscera, disturbances which it would seem are ascribable to errors of the involuntary nervous system of the organs affected. Some of these conditions are rare, others are so frequent and so common that they must enter into the clinical experience of the vast majority of practicing physicians.

I begin by recalling a few facts concerning the distribution and what we know regarding the physiology of this interesting but intricate system. It is evident that physiology has been and continues to be the torch which has enlightened a field otherwise dark and obscure.

A CONTRAST OF REFLEXES

I have found it helpful to myself and an aid to a memory none too retentive to appreciate the arrangements of the involuntary nervous system spinal reflex in contrast with the disposition of the voluntary nervous system reflex.

In the voluntary system the motor nerve cell lies in the gray matter of the anterior horn of the spinal cord, and the nerve fiber which arises therefrom is medullated in structure, efferent in direction, and effector in function. The afferent fiber, incorporated in the embrace of the mixed nerve and connected with the station of the posterior root ganglion, breaks into its synapse around the cell of the posterior horn, which latter completes the circuit by transmitting a connector fiber to synapse with the cell of the anterior horn.

The spinal arrangements of the involuntary system are different, and yet there is a curious similarity when the two pictures are considered. The effector nerve cell of the involuntary impulse occupies an extracordal position, usually in a ganglion. From it the effector fiber proceeds in a peripheral direction, and as such it is non-medullated in structure (gray rami communicantes), while it may be described as postganglionic in position. Its course may be an independent one, or it may be incorporated in a mixed nerve with the medullated tissues of voluntary nerves. The afferent fibers of the system follow the course of the posterior nerve roots. Communicating with the posterior root ganglia, they enter the spinal cord in the region of the posterior horn, but their ultimate synapse is around a group of cells which lie in the lateral portion of the gray matter ventral to the site of the posterior horn cells. The circuit of the reflex is completed by fibers which pass from the lateral horn cell to synapse with the effector cell of the sympathetic ganglion, and these fibers, connector in function, are medullated in structure (white rami communicantes), and in virtue of their position it is correct to describe them as preganglionic.

As far, therefore, as anatomical relations are concerned, the points which distinguish the

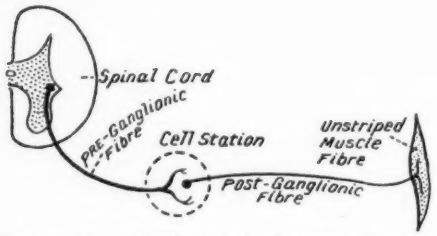


Fig. 1. Diagram showing relation between preganglionic and postganglionic fibers. (From *Essentials of Physiology*, Bainbridge and Menzies.)

spinal arrangements of the involuntary nervous system from those of the voluntary are that the effector cell is extracordal in position, that its fibers are non-medullated, that the connector fiber extending from a nerve cell of the lateral horn to synapse with the effector unit of the ganglion is partly intracordal and partly extracordal, and is accordingly a medullated structure. Hence the entire sympathetic pathway from the spinal cord to the periphery is composed of two sets of neur nes, preganglionic and postganglionic. Their number, however, may not be limited to two, for in place of the second neurone there may be two or three, or in one case none (preganglionic innervation of the adrenals).

We cannot be blind to the interests of the phylogenetic aspects of the question. Has the ganglionic tissue migrated from the spinal cord to form an extracordal center, or is it in process of inclusion within the spinal matrix? While, however, we may be alert to the attraction of the problem, this is not the place for its discussion.

I have traced an outline of the spinal arrangements of the involuntary nervous system, but the issues are wider than this simple appreciation.

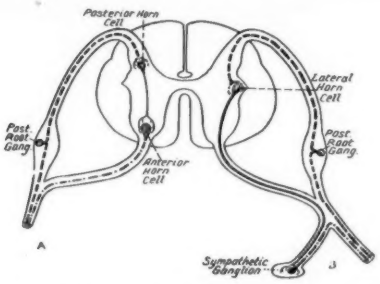
DIVISIONS OF THE INVOLUNTARY NERVOUS SYSTEM

The physiologist and the anatomist have suggested the division of the involuntary nervous system into two groups, sympathetic and parasympathetic, and, to appreciate the clinical aspects of this paper, it is essential that we have some appreciation of the grounds upon which the distinction has been based. It is convenient to consider these under the headings of (1) position, (2) function, (3) distribution, (4) relation to adrenals, and (5) psychological and metabolic distinctions.

The distinction of position. The entire true sympathetic system has its origin in the spinal cord. From the level of the eighth cervical to the third lumbar segment, the axones which emerge with the anterior roots run their course to the ganglionated cord *via* the white rami communicantes. In contrast, the parasympathetic outflow is in relation to the poles of the cerebrospinal axis, the impulses being transmitted from the midbrain and the medulla through the oculomotor, the chorda tympani, and the vagus, and from the sacral segments through the pelvic nerves. In virtue of its position in relation to the cerebrospinal axis, the term "bulbosacral" is used as synonymous with "parasympathetic."

2. *The distinction of function.* As these two systems show a difference anatomically, so they demonstrate a physiological distinction. It may be said that their respective functions are sharply contrasted throughout; stimulation of the cervical sympathetic leads to dilatation of the pupil, stimulation of the fibers of the oculomotors (parasympathetic) produces pupil contraction; stimulation of the vagus (parasympathetic) results in slowing of the heart's action, stimulation of the cardiac nerves of the true sympathetic system leads to acceleration of the heart's action.

Where the enteric system is concerned, while a demonstration of the respective functions is difficult, it is evident that the two portions of the involuntary nervous system are to some extent antagonistic the one to the other, and while it may not be wise to accept as accurate the generalization that "stimulation of the splanchnics leads to inhibition of the intestinal peristaltic movements while stimulation of the vagus has the reverse effect," there can be no doubt that the two portions are to some extent antagonistic to one another. It is true that in certain situations—the lower end of the œsophagus and the cardiac portion of the stomach, and probably certain sections of the large intestine—a single type of supply, either parasympathetic or sympathetic, is provided, so that in such event both varieties of impulse are trans-



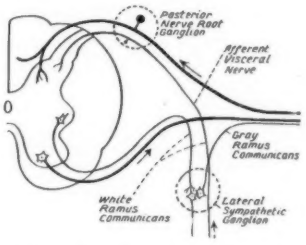


Fig. 2 (left). The paths of the reflex. *a*, Path of the ordinary spinal reflex; *b*, path of the sympathetic spinal reflex. (From *The Sympathetic Nervous System in Disease*, Langdon Brown.)

Fig. 3. Diagram of spinal segment showing the somatic and visceral nerve roots. (From *Physiology*, Lyle and deSouza.)

mitted by the same channel, yet the central fact is unaltered, that the functions of the two divisions are antagonistic, and that in health the co-ordinated action of the two types of function is so carefully balanced and adjusted that healthy tone results. This combination of opposing functions is particularly exercised if special muscular arrangements exist, as in the sphincters of the alimentary tract.

3. The distinction of distribution. It is characteristic of the sympathetic division to possess a short preganglionic medullated fiber, while the peripheral postganglionic segment is long. The reverse is true where the parasympathetic is concerned, for in this instance the preganglionic fiber is long while the postganglionic fiber may be so short that it exists only within the effector organ.

In point of fact, the orientation of the two systems is wonderfully similar; the cell station ganglion is common to both, the distinction lying in the respective lengths of the preganglionic and postganglionic fibers. This distinction is of some clinical importance, for the relative proximity of the parasympathetic cell station to its end organ results in a localized function response, while the stimulus of the sympathetic fiber is followed by a wide and diffuse reaction.

4. The distinction of relation to adrenals. The innervation of the adrenals is unique in so far as it is a preganglionic sympathetic one. The explanation of this apparent anomaly was advanced by Gaskell, who suggested that the evidence of embryology and comparative anatomy indicates that the sympathetic nervous system arose from cells containing adrenalin, and that, when these cells left the central nervous system to become peripheral, they left not as single cells, but as two separate cells, one of which contained all the adrenalin and formed the chromaffin system, and the other the nerve cells of the sympathetic system of the vertebrates. It is evidently in this way that the preganglionic innervation of the adrenals is to be explained, and the force of Langdon Brown's remark that "the chromaffin cell represents the excitor element" is thus appreciated. The close relationship of the adrenals to the sympathetic as opposed to the parasympathetic is a striking and important distinction.

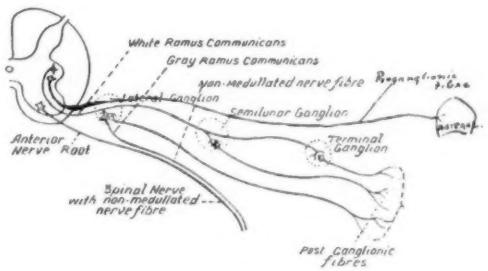
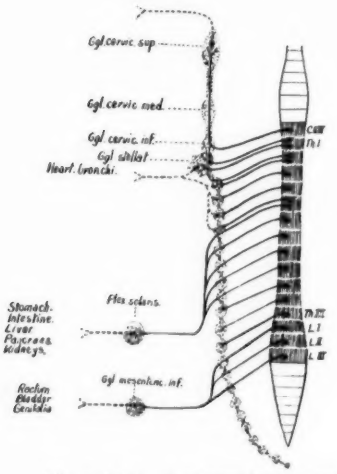


Fig. 4. A diagrammatic representation of the various ways in which the respective neurones may be arranged. While the preganglionic fiber must obviously be a single unit, the postganglionic neurone may be arranged through the medium of one or more substations. In the case of the involuntary nerve supply to the adrenals there are no postganglionic fibers, as the supply is directly through the preganglionic. (Modified from *Physiology*, de Sousa.)



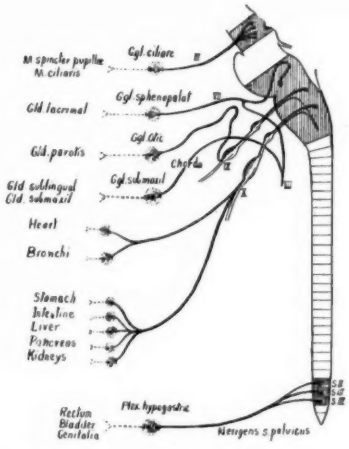


Fig. 5 (left). A schematic representation of the sympathetic distribution.
Fig. 6. A schematic representation of the parasympathetic distribution.

5. *Psychological and metabolic disturbance.* In Dr. Louis Berman's vivid essay "The Glands Regulating Personality" the types of character are indicated which the sway of endocrine secretion might produce. This thesis may be applied with some measure of assurance to the functional distinction between sympathetic and parasympathetic divisions of the involuntary nervous system, for the sympathetic is the medium by which the defence mechanism of the body is stimulated, while the parasympathetic is the source of "Nature's opiate." From a metabolic basis, too, a distinction is apparent, for the sympathetic is katabolic in its effects while the parasympathetic is anabolic.

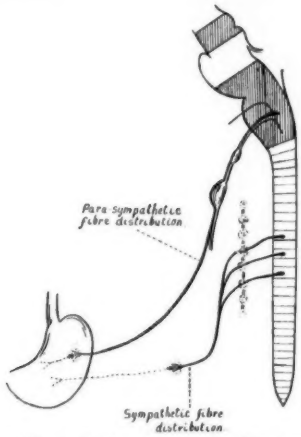
There are probably many other lines of distinction the force of which we do not as yet appreciate, but I have enunciated sufficient to show that a very real and definite distinction, partly anatomical, mainly physiological, exists between the sympathetic and parasympathetic divisions.

THE EVOLUTION OF THE INVOLUNTARY NERVOUS SYSTEM

It is a necessity in the clinical thesis which follows that we possess some idea of the evolution of the involuntary nervous system, and particularly of the order in which the various functional activities of the system are acquired.

In a general sense it is true to say that the nervous system of man is composed of three elements—receptor, effector, and the all-important link which connects the two and by so doing completes and controls the reflex, the connector or adjustor fiber. The perfection of such a mechanism, however, has been the result of an age-long evolution, and it is interesting to observe the steps of that process as they are evidenced in the living organisms of today.

Experimental and biological investigation has failed to reveal any evidence of a nervous system in the simple organism of the finger sponge (olynthus) or in the better known 'community' type of bath sponge, and yet the economic life of the creature is governed by a definite process of cause and effect. The outer surface is perforated by a series of pores which lead into a system of canals each lined by "lash" cells, the function of which is to propel the water through the canals into a large space in the center of the sponge, from which the fluid ultimately escapes by a single large opening (the osculum). From the current of fluid in circulation the creature extracts the necessary nourishment, and the production and the control of this current are



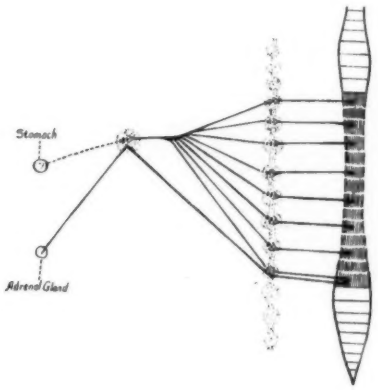


Fig. 7 (left). Diagram to illustrate the long preganglionic fibers characteristic of the parasympathetic and the short preganglionic arrangement of the sympathetic.
Fig. 8. A schematic representation of the preganglionic supply of the adrenals in contrast with a typical sympathetic supply.

the essential features of its existence. The direction and the degree of the current are controlled by such simple arrangements as a slight contraction and bending of the body as a whole, the formation of protoplasmic membranes which temporarily close the openings, and the action of layers of simple muscle cells which surround the pores and the exit openings. No trace of nerve cell or fiber is apparent; the responses are put into operation by direct stimulus without any associated nervous impulse—a local response to a local stimulus.

On the other hand, when an expanded sea-anemone (actinia mesembryanthemum) is stimulated by contact, it responds by a general contraction of its body musculature, and the response follows a stimulus to any part of the body wall—a local stimulus followed by a general response, for a nerve net spreading throughout the body substance brings any and every portion of the body surface into association with its entire musculature. The stimulus of the receptor is conveyed directly to the effector through the medium of a nerve net, but there is no control or adjustor element.

It is in the earthworms (annelida) that the first evidence of an adjustor mechanism becomes apparent. On the dorsal aspect, in the anterior extremity of the creature there is a small collection of nervous matter which may be termed a brain, while connected with this, and extending along the ventral mid-line is a segmented chain of ganglionic enlargements. Primitive in its arrangement such a central nervous system may be, and yet a very real advance in the evolutionary trail, for it contains the internuncial neurones which constitute the beginnings of the adjustor or connector mechanism. In the scheme of evolution, muscle first functioned as an independent effector; receptors or triggers for activating the muscles were afterward developed, the diffuse nerve net acting as the organ of transmission and intercommunication; and finally a central nervous organ was evolved at the site of the adjustor or connector mechanism, a tissue or group of tissues which eventually adopted the function of modifying responses in relation to past influences until it has become a storehouse of experience and the center of the intellectual life (Parker).

Such is the sequence of the evolution picture, and it will be apparent that the place of the involuntary nervous system is an intermediate one, later than the local response of the finger sponge, the nerve net of the anemone, or the ganglionated cord of the annelidæ, and yet antedating the voluntary nervous

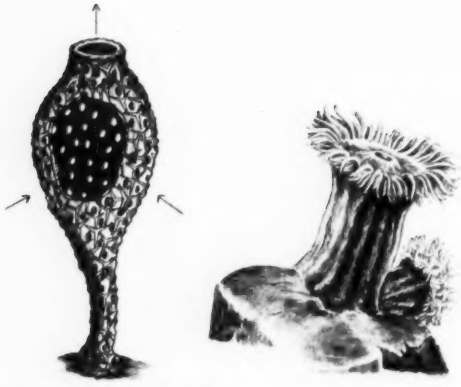


Fig. 9 (left). The olynthus stage of a sponge. The water enters through the lateral pores and leaves through the central osculum. A window has been made to expose the interior.

Fig. 10. The sea anemone (actinia mesembryanthemum). Nerve impulses are transmitted through the medium of a nerve net, a local stimulus is followed by a general response.

system by a space impossible to estimate. Where the path of evolution leads it is impossible to say, but it is significant that the involuntary nervous system of man is linked with an intracordal station, and it might be argued that at some time in the distant future the so-called involuntary system of today will pass entirely under voluntary control.

In such a consideration of the phylogeny of the nervous system, the question naturally arises: "What is the respective phylogenetic position of the parasympathetic in relation to the sympathetic?" The parasympathetic is evidently a later acquisition for the following reasons: (1) its position in relation to the extremities of the cerebrospinal axis; (2) its relation, in part at least, to that portion of the cerebrospinal axis which has been a late acquisition in the phylogenic tree, the mid-brain and medulla; (3) its great length of medullated nerve structure.

It is interesting and significant that in the enteric system we find functional manifestations illustrating the different varieties of neuromuscular stimulus and response—the involuntary muscle of small intestine responds by local response to local stimulus, as does the sea sponge; in the same tissue a local stimulus may result in a widespread response, the

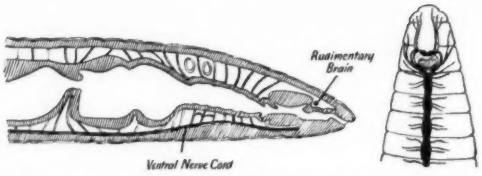


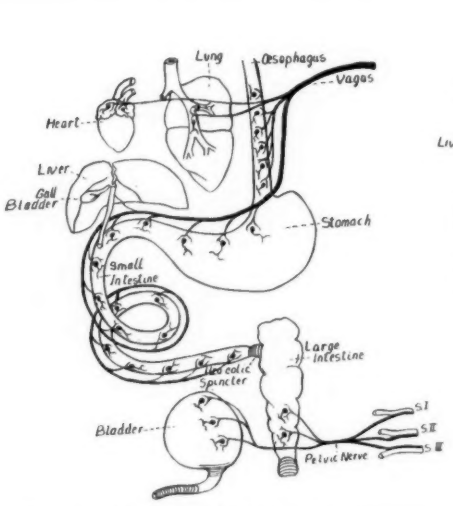
Fig. 11 (left). A longitudinal section of an earthworm to illustrate the ventral nerve cord and rudimentary brain (the suprapharyngeal ganglia).

Fig. 12. The forepart of the nervous system of the earthworm, illustrating the rudimentary brain, the ganglionated ventral nerve cord and the afferent and efferent nerve filaments.

stimulus being distributed as in the anemone through the medium of a nerve net; on the other hand, many intestinal muscular reactions are in response to a true reflex transmitted by afferent channels through the ganglionated cord and thence to the effector organ, the reflex remaining outside the central nervous system, while others are transmitted through the pathway of the spinal cord.

THE ORDER IN WHICH THE FUNCTIONAL ACTIVITIES ARE ACQUIRED

The primary changes which result from the activity of involuntary nerve tissues are contraction and inhibition. Relaxation is the natural sequence of contraction, and can scarcely be grouped as an independent functional activity. It is of peculiar interest to know whether in the process of development these functional activities are acquired synchronously or whether one precedes the other, and if so which. An answer must necessarily be difficult, and at the best uncertain, but I venture to suggest that a measure of information is obtained from the evidence afforded by a simple experiment on the sea anemone. When the creature is fed with small particles, the food is collected by the tentacles and passed into the central cavity, where it is ultimately digested. If fragments of filter paper soaked in meat juice are alternated with the meat, both materials are at first accepted indiscriminately—but not for long! After some eight or ten experiences the meat is accepted, while the filter paper is rejected. Inhibition has been exercised, but as a secondary and subsidiary function. The experiment



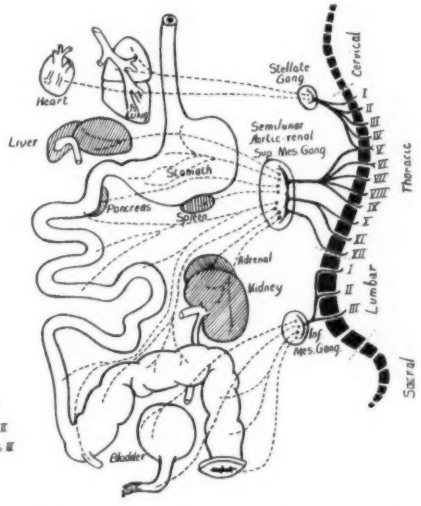


Fig. 13 (left). The distribution of the parasympathetic or bulbosacral system. (From the *Symptoms of Visceral Disease*, Pottinger.)

Fig. 14. Schematic illustration of the sympathetic innervation of the enteric system. (Modified from *Symptoms of Visceral Disease*, Pottinger.)

affords information which suggests that motor activity precedes the acquisition of the function of inhibition, and from a logical standpoint it would seem likely that the exercise of inhibition is at first experimental and selective, only later becoming a systematized part of the neuromuscular responses.

THE DISTRIBUTION OF THE SYMPATHETIC AND PARASYMPATHETIC NERVOUS SYSTEMS IN RELATION TO INTESTINAL FUNCTION

It is difficult to be dogmatic in regard to the visceral distribution of the involuntary nervous system, but certain generalizations may be made. The œsophagus and the cardiac portion of the stomach are supplied by the parasympathetic, both motor and inhibitory impulses being conveyed along this channel. In the pyloric half of the stomach, the sympathetic first becomes evident, and from this point onward as far as the ileocæcal region there is a combined distribution of sympathetic and parasympathetic elements, the former motor, the latter inhibitory in its effects. The large intestine, as far as the lower end of the pelvic colon, is evidently the site of a pure sympathetic distribution, motor and inhibitory functions being distributed along this channel. The remaining portion of the large intestine and the rectum combine a sympathetic and a parasympathetic supply, the former being inhibitory and the latter motor. Particularly important in view of the pathology presently to be discussed are those areas in which the various types of supply meet or overlap—the pylorus, the ileocæcal junction, and the lower reaches of the large intestine.

THE PATHOLOGICAL ASPECTS

The involuntary nervous system is in a somewhat unique position, for, while its anatomy and physiology are to some extent elucidated, and the clinical evidences of derangement recognized, the pathology from which these clinical derangements have sprung remains obscure. We are, therefore, driven to think in terms of clinical pathology, in terms of the derangements of function which an obscure pathology produces.

Recalling what we know of normal enteric functions, it is possible to conceive of four types of derangement: (a) abnormal stimulus of contraction (spasm); (b) the exertion of

inhibition on contraction, leading to persistence of contraction (achalasia); (c) the exertion of inhibition on relaxation (atony); (d) irregularity of the co-ordination between contraction, relaxation, and possibly of inhibition (arrhythmia). It is in a consideration of these various manifestations, their incidence, their localities, their possible explanations, that the real interest of the subject at present lies.

FEATURES OF INCIDENCE

If we search through the span of life and consider those intestinal or enteric disturbances which are neither inflammatory, neoplastic, nor yet very evidently and primarily mechanical, we arrive at an interesting and suggestive analysis. We find that in the weeks or months which succeed the birth of the child, there are certain local muscular hypertrophies of an obscure origin, hypertrophies affecting local segments and usually the sphincteric regions of the gut—the pylorus, the ileocæcal region, and the pelvirectal or O'Beirne's sphincter—or, to describe them in clinical phraseology, congenital stenosis of the pylorus, congenital hypertrophy of the ileum, and congenital hypertrophy of the colon or Hirschsprung's disease. The origin of these conditions is intimately related to the early days of life, though their effects may persist throughout the later years, and as primary manifestations nothing resembling them is encountered in later life. These conditions may be conveniently grouped as the "congenital hypertrophies."

A little later in the cycle of life, at a period which corresponds to an interval from the sixth month to the second or third year, we encounter those curious peristaltic disturbances which result in the intussusceptions—abnormal and irregular peristaltic rhythms, arrhythmias, exaggerations of physiological action which by reason of peculiar mechanical conditions give rise to serious pathological pictures, uneducated and misguided types of peristalsis, clinical entities of a peculiar type, and distinctive of a sharply defined period of early life.

From the second year onward to puberty there are virtually no manifestations such as we have adumbrated. It would seem as though the education of whatever mechanism may have been at fault had been completed, and adjustment of error arranged; at any rate the period is one peculiarly free from functional disturbance. With the passing of puberty, however, as though an interval of calm had been passed, the lives of many individuals become troubled with a great variety of obscure and puzzling enteric errors—spasms, achalasias, and atonies. Transient, almost ephemeral, many of them are, vanishing in the unconsciousness of anæsthesia, leaving virtually no pathology after death, and yet producing a very real symptomatology, which, if not serious when the risk to life is concerned, yet exerts far-reaching influences when the mental health and comfort of the individual are concerned.

So regular are the periods of incidence of the conditions I have in mind that I am able to chart them upon the time table of life—the hypertrophies so early as to be virtually congenital, the arrhythmias distinguishing the months when an independent existence is first becoming established, the period of functional well-being as though the lesson had been learned and adjustment secured, the phase of the minor disturbance, as though adjustment were failing anew, or an independent pathology becoming established.

THE INDIVIDUAL CONDITIONS

Let us now briefly consider in more detail the nature of certain of these disturbances.

1. The hypertrophies of infancy. The distinctive features of congenital hypertrophy of the pylorus are well known—a hypertrophy of the muscular coats of the pyloric canal and antrum, and to a lesser degree of the distal portion of the body of the stomach. The circular fibers of the pyloric sphincter are not affected, and it is correct to say that the change involves that portion of the stomach musculature which is concerned with the expulsion of contents. The abnormality in function of an organ so affected becomes apparent on X-ray examination. There is an ill-timed and abnormal, yet forcible and prolonged, contraction of the stomach muscle, and, because of the very incoherency of the function, contents are prevented from leaving the stomach.

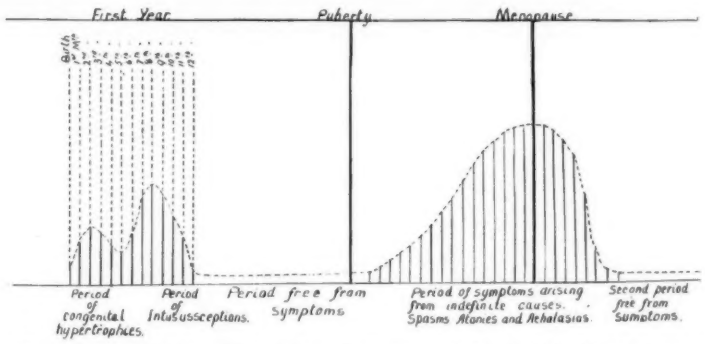


Fig. 15. A schematic representation of the age periods at which disturbances of the enteric system ascribable to the involuntary nervous system appear.

The problem has been to account for the muscular hypertrophy. The theory of the congenital redundancy of growth, as suggested by Hirschsprung, Cantley, and others, finds few supporters, and the view which Thomson first enunciated, that "the muscle is hypertrophied because from an early period in its development it has been worried into overgrowth by constantly recurring overaction such as would result from even a slight degree of habitual inco-ordination," is now in favor. It is apparent that a demonstration of the origin of the disease is, and is likely to remain, a matter of great difficulty, but there are certain facts which help us. We must bear in mind the observation so frequently made, that, if the body strength can be maintained, these cases pass to a natural cure by a disappearance of the hypertrophy. We have the knowledge which John Hunter first gave us that the tendency to hypertrophy as the result of repeated forcible contractions is peculiarly well marked in involuntary muscle. We have the observation, which I believe Cameron first made, that the hypertrophy does not affect the circular fibers of the true pyloric sphincter, that there is in fact no actual obstruction—a truth which may be confirmed at operation—and it is probably significant that the change occurs at a situation in which a pure parasympathetic nerve supply merges into an area in which a mixed sympathetic and parasympathetic supply exists.

Hypertrophic ileal obstruction. During the 13 years I was privileged to act as a member of the staff of the Edinburgh Royal Hospital for Sick Children I operated on three obscure and interesting cases of intestinal obstruction in babies. The history in each case was similar. At birth the child appeared to be well and meconium was passed, but at a period which varied from 4 days to 3 weeks after birth, signs of obstruction developed. There was vomiting of bile-stained fluid; the bowels, which had always been constipated, now ceased to act, the abdomen became distended, and a ladder pattern of small intestine was apparent. Repeated enemas usually succeeded in evacuating small amounts of bile-stained fæcal matter of a somewhat inspissated type. Laparotomy showed coils of dilated small intestine, but the lower 6 inches or thereabouts of the ileum was the site of a most marked hypertrophy, so marked, indeed, that in the first case I saw I mistook the condition for a hypertrophic type of small intestine tuberculosis. In the two subsequent cases I recognized that the condition was a muscular hypertrophy proceeding from some obscure cause.

In the first case an ileostomy was done, unfortunately, as I now recognize, for the child succumbed, while in the other instances the abdomen was closed and recovery ultimately ensued, though constipation remained a difficulty.

I believe that these cases were examples of a disease similar in pathology and in origin to congenital hypertrophy of the pylorus. Again, it is significant that the lesion occurred where

the parasympathetic nerve distribution probably ends and a pure sympathetic supply is continued; as in the pylorus, the segment affected is that immediately proximal to the actual sphincters, and there is the same tendency toward spontaneous recovery.

Amnon first described congenital hypertrophy and dilatation of the colon in 1842, but the classical account which Hirschsprung gave in 1886 has led us to associate his name with the disease. Its characteristics are dilatation of the distal colon, hypertrophy of the muscular coats, both circular and longitudinal, and of the muscularis mucosæ. The peritoneum and mesocolon are thickened, the associated blood vessels, lymphatics, and lymphatic glands are enlarged, and in a well-established case the mucous membrane is thickened and often ulcerated. Many of these appearances, however, are secondary in their incidence, and those who have had an opportunity of seeing such cases in babies in the early stages of their development agree that hypertrophy of the muscular coat and dilatation of the colon canal are the original and the primary features. The lower limit of the change is usually at the junction of pelvic colon and rectum (O'Beirne's sphincter), but in a few instances the hypertrophy and dilatation extend downward to the level of the anal sphincter.

It is apparent how similar is the condition to those mentioned above; occurring as it does at a situation where a sympathetic nerve supply comes into contact with a parasympathetic distribution, affecting a segment of gut on the proximal side of a sphincter, associated with hypertrophy of the muscular fibers (though in this instance the gas content of the large bowel produces a coincident dilatation), the disease first becoming evident in the weeks which immediately succeed birth —a combination of circumstances suggesting an etiology similar to that of congenital hypertrophy of the pylorus and congenital hypertrophy of the ileum.

I might add additional examples of the congenital hypertrophies—the congenital cardiospasm which Fleiner described, and the congenital hypertrophies of the bladder—all possessing very similar characteristics, but my point has been gained if I have succeeded in showing that in the early weeks and months of life we find highly distinctive derangements of the non-striped muscle of the alimentary tract, which are characterized by hypertrophy, which occur in situations where different types of nerve supply intermingle, which under certain conditions eventually undergo restoration to normal, and which are without parallel in the later years of life. It has seemed to me that the process which explains these errors is one which in its beginnings is functional, a delay in the acquisition of the power of inhibition by certain segments of the alimentary canal, segments which are proximal to sphincters and which correspond to areas of different nerve type junction.

As I have recalled in the simple experiment of feeding the sea anemone, the acquisition of inhibition lags behind the functions of contraction and relaxation, and in the diseases which we have under review it may well be that an undue delay in the appearance of the function of inhibition will explain the peculiar pathology, a hypertrophy which results from an uncontrolled contraction and relaxation. With the acquisition of the function of inhibition the stimulus is controlled and the hypertrophy disappears.

2. *The arrhythmias of early childhood.* While the distinctive feature of involuntary nerve errors of the early weeks and months of life is localized hypertrophy, the derangements of a later period are characterized by an exaggeration of the normal function of the muscular coats, the function of peristalsis, and as a result we find that during a period which extends roughly from the sixth month to the end of the second year, intussusceptions, the results of an excessive and misguided peristalsis, are met with. In the last 300 cases of intussusception operated on in the Edinburgh Children's Hospital, 295 had their beginnings in the small intestine, in the lower end of the ileum, where after reduction the original point of invagination remained apparent. Now the muscle of the small intestine demonstrates three varieties of activity:

a. *A segmentation movement*, an example of a local response to stretching by contents, and one independent of the myenteric reflex. The aim of this

movement is to break up masses of food and to bring the nutritive material into close association with the absorptive mucosa of the gut. Because of it, food passes up and down the gut for a few centimeters only. The process is analogous to the local stimulus and local response of the finger sponge.

b. True peristalsis (*diastalsis*). In this instance the stimulus is chemical rather than mechanical, and a wave of inhibition always precedes the contraction, which moreover invariably progresses in the distal direction. This movement depends upon the integrity of the nerve net, for, if repeated encircling incisions be made through the musculature or the small intestine so as to interfere with the function of the myenteric nerve plexus lying between the muscular coats, the movement is abolished. The function of this type of peristalsis is to pass the nutritive material on for some considerable distance in order that fresh areas of absorption and digestion may be reached. In this instance, the process is analogous to that which pertains in the sea anemone.

c. The peristaltic wave. Under certain conditions the true peristaltic wave may advance at a very rapid rate. This is called "the peristaltic rush," and it is evidently in this way that intussusception is induced. It is a swift wave of peristalsis, which may sweep over the entire length of the small intestine in about one minute, and it was first observed by Van Braam-Houckgeest in rabbits killed by asphyxia. The confused squirming of the coils as the contraction rushes along has caused the phenomenon to be designated the "Rollbewegung," or the vermicular wave. It is likely that this manifestation is apparent under abnormal conditions only.

That the rushing wave is actually peristaltic in character was proved by the observations of Sneltzer and Auer. They showed that it consists of a contraction preceded by a completely relaxed section of gut, and they were able to evoke the phenomenon in rabbits by intravenous injection of a combination of substances designed to produce simultaneously stimulation and inhibition of intestinal activity. The most effective pair was ergot (stimulant) and calcium chloride (depressant).

When the phenomenon occurs in the child the wave is carried with some degree of violence throughout the length of the small intestine. As long as inhibition precedes contraction no harm results, but when the wave reaches the lower end of the ileum, an area in which a new type of nerve supply is encountered, under certain conditions the preceding phase of inhibition is not transmitted, with the result that the strong contraction of the "peristaltic rush" carries a circular area of the gut into the distal segment as an invagination, and the intussusception begins. I said that the event was likely to occur only under certain conditions, for every child who evidences the "peristaltic rush" does not develop intussusception; a developmental anomaly is the predisposing feature, for, if the ileocæcal segment has failed to complete its fixation to the posterior abdominal wall, if, in other words, the third stage of intestinal rotation has not been completed, and the ileocæcal segment is provided with a loose mesenteric attachment, the occurrence of a peristaltic rush is likely to be followed by the development of intussusception. Why this should be is difficult to explain. The laxity of the attachment offers a mechanical explanation of the migration of the intussuscepting segment, but in all likelihood there is a further influence which concerns the nerve supply of the bowel, a congenital deficiency in the nodal tissue in the ileocæcal segment.

It is natural that we should inquire about the origin of the peristaltic rush. In view of the experimental work of Sneltzer and Auer we are tempted to imagine that some dietetic error which combines the depressant and the stimulant factors may be the source, but, even so, the original stimulus, whatever it may be, is acting upon an intestine which in some way is predisposed to disturbance of this nature, a bowel the functional education of which is not yet adjusted and stabilized.

3. The disorders of adult life. At some time subsequent to puberty there is in certain individuals a further breakdown in the neuromuscular alimentary arrangements; not immediately serious as are the hypertrophies of the early months, and the arrhythmias of the early years, yet ultimately of great importance from various points of view, psychological, diagnostic, and toxæmic. The disturbances of these later years are most elusive in their etiology and pathology. In view of the time period of their manifestation and the response which many cases show to glandular therapy, it may well be that a derangement of the glands of the internal secretions is the origin of the nervous disturbance. From what I have seen I am convinced that an imperfect attachment of the cæcum and ascending colon to

the posterior abdominal wall is a frequent, in fact I would say a constant, accompaniment of the functional disorders; that, in other words, an abnormal type of intestinal arrangement exists to make such disturbance possible.

We must, however, confess that our knowledge of the etiology remains largely hypothetical.

The pathology is as difficult of demonstration as the origin. Spasms, achalasias, and atonies express the changes which give rise to symptoms, yet, except in the case of the atonies, many of them are transient; they vanish during anæsthesia and operation, and they leave no pathological condition which can be demonstrated postmortem.

It is, however, in respect of diagnosis that a great interest lies. During 6 months' work in the Edinburgh Royal Infirmary, I have kept a careful record of 58 cases sent to the hospital with the diagnosis of appendicitis. Twenty-four of these showed pathological conditions of the appendix, 34 were examples of ileocæcal pain certainly, but the explanation was not an inflammatory lesion of the appendix, but a spasm of the cæcum and the related colon. There was a diagnostic error which exceeded 50 per cent.

Similar figures exist in relation to the stomach, where gastric and pyloric spasm and achalasia of the pyloric sphincters have closely simulated stomach and duodenal disease. It is true that many of these disturbances are reflex, and in some instances the association is obvious, but in many it is impossible to discover the source from which the derangement is proceeding. Pain and functional derangements are the usual symptomatic evidences of the spasms and achalasias.

PHLEGMONOUS GASTRITIS

An Anatomical and Clinical Study of Two Cases

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THE diagnosis of phlegmonous gastritis is of importance because, contrary to the usual belief, this condition is neither extremely rare nor necessarily fatal as instances of recovery after operation are on record in undoubted cases of both the circumscribed and diffuse varieties.

That phlegmonous gastritis is much more than a pathological curiosity is shown by the fact that Riegel (15) found about 50 reported cases up to 1905, while Lehnhoff (11) reported in 1917 that he found about 150 cases reported in the literature. This rapid increase in the number of reported cases is again emphasized by the fact that Sundberg (19) found 215 reported cases in the literature up to 1919, Anderson (2) found 220 instances up to 1922, and Brumm (7) reported that 219 cases were described in the literature up to 1925. The fact that there has been such a rapid increase in incidence of phlegmonous gastritis speaks strongly in favor of the view that this condition is much more common than is generally supposed and that it was formerly regarded as a very rare condition simply because there were not many reports in the literature. This opinion is further supported by the fact that Sundberg (19) reported 17 cases observed by him personally up to May 15, 1919.

The cause of this interesting condition is usually the streptococcus (MacAuley, 12; Bossart, 5) and Sundberg (19) states that this organism was found in the stomach wall in 71 of 95 cases examined bacteriologically. Other organisms found in this condition were hæmolytic staphylococci (Zoeppfel, 20) and the pneumococcus (Adams, 1, quoted by MacAuley). The mode of invasion is more difficult to determine. Some authors favor the idea that this condition is simply a localized point in a focal infection as from the tonsils, erysipelas, or after operation for hernia (Fink, 10). Cases which followed sore throat were reported by Lehnhoff (11) and by Brooks and Clinton (6). Conge and Micheleau (8) reported a fatal case following the development of erysipelas subsequent to an operation for removal of the lachrymal sac. On the other hand, there are numerous instances in which some local condition could explain the origin of the phlegmonous inflammation. Sandelin's (16) case showed carcinoma of the stomach. The same was true in a case reported by Brumm (7) and in one of our patients. Bircher (3) and several others found a gastric ulcer as a possible portal of entry for the causative organism and Anderson (2) mentions cirrhosis of the liver as a possible factor in his case. Both Anderson and Sundberg lay considerable stress on low gastric secretion permitting the causative organism to gain a foothold in the stomach wall, and they support their contention by the findings in their own cases. In this connection it is interesting to note the experiments of Shatara (17) who was unable to produce experimental phlegmonous gastritis by feeding ground glass with bacteria to dogs. One of our own cases may throw some light on a possible way in which phlegmonous gastritis may occur. The patient had a streptococcic pneumonia and several days later developed phlegmonous gastritis. Cultures from the submucosa of the stomach also revealed streptococci. This case would tend to support the view that phlegmonous gastritis may

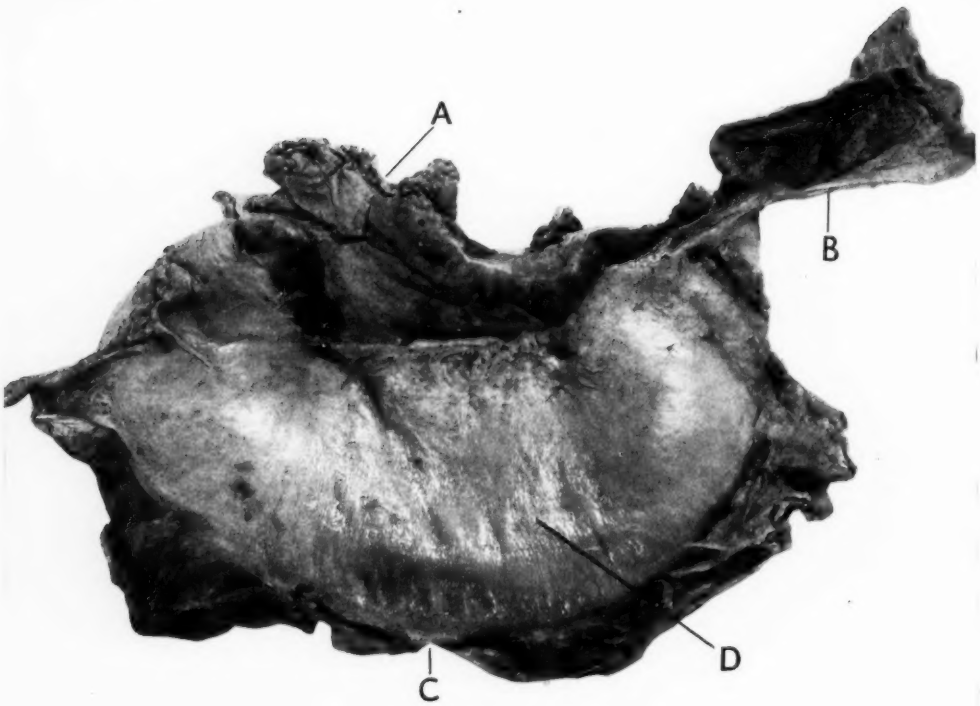

Fig. 1. Photograph of specimen in Case 1 showing, *A*, sharp demarcating line between normal œsophagus and the adjoining inflamed mucosa of the stomach; *B*, normal duodenum; *C*, greater curvature of the stomach; *D*, body of the stomach, which is boggy and almost translucent.

result from a generalized infection or by spread from some other focus. At the same time our second case, which was also of the diffuse variety, seemed to be dependent on a carcinoma of the stomach. We are led to conclude that phlegmonous gastritis may result either from generalized bacteræmia or from some local process in the stomach, especially if there is low gastric secretion.

Once the invading organism gains a foothold in the tissues of the stomach the process develops either as a localized abscess, usually in the pyloric region or as a diffuse, seropurulent inflammation of the entire stomach wall. The feature of interest in both varieties is the fact that the submucosa is the layer which bears the brunt of the inflammation and shows more change than any other layer. Many authors (Riegel, 15; Novak, 14; Brumm, 7) state that the process originates in the submucosa, a belief which is supported by the fact that the pathological changes are most marked in this layer.

The actual changes depend upon whether the process is localized or diffuse. The localized process may resemble an abscess beginning in the submucosa (Novak, 14) which becomes œdematous, pale, and yellowish white and may cause a marked bulging of the mucosa and muscularis or this tumor-like abscess may perforate externally (Bircher, 3; Zoeppfel, 20). The diffuse form is much more common and is the type found in both of our cases. The submucosa which is normally relatively thin when compared to the thickness of the entire stomach wall may form

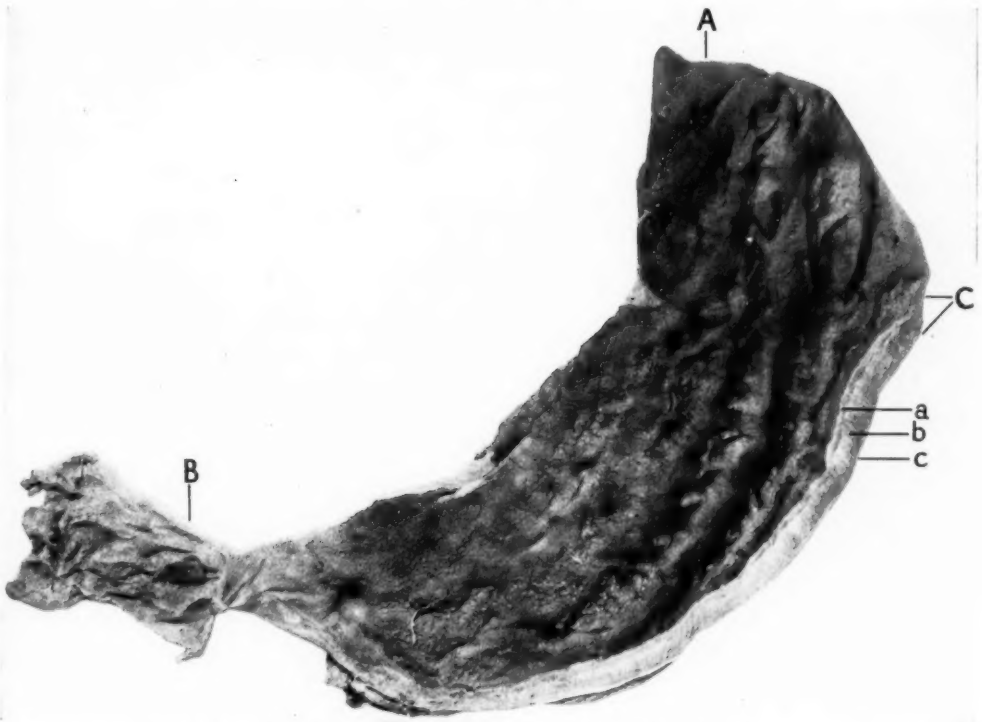

Fig. 2. Cut section of stomach in Case 1. *A*, œsophagus; *B*, duodenum; *C*, thickened stomach wall consisting of *a*, mucosa of normal thickness, *b*, submucosa markedly increased, *c*, serosa of comparatively normal thickness.

more than two-thirds of its thickness. This unusual increase in thickness, together with the fact that the layer becomes succulent, pale, œdematous, and that seropurulent fluid may be easily expressed from the interstices of a cut section of this tissue forms the characteristic picture of acute phlegmonous gastritis. The fluid which pervades the connective tissue of the submucosa and which is the chief factor in its increased thickness is at first seropurulent and may later become purulent. An interesting feature is the fact that the process is limited to the stomach and does not extend beyond the œsophageal or pyloric orifices (MacAuley, 12). Of further interest is the common finding that the mucosa is velvety, flat and without rugæ, and most authors describe the mucosa as being intact except for an occasional superficial erosion which does not have any apparently direct connection with the process in the submucosa (Anderson, 2; Moynihan, 13; Bircher, 3; Eurich and Phillips, 9; Shatara, 17). This extensive, purulent infiltration of the stomach wall naturally gives rise to a severe clinical syndrome which consists of the signs and symptoms usually associated with an acute surgical condition of the abdomen together with definite septic phenomena. This typical picture is not always present and was practically absent in both our cases.

According to most of the reported cases the onset is usually sudden (Novak, 14; von Stapelmohr, 18; Bossart, 5; Anderson, 2; MacAuley, 12), with severe abdominal pain, tenderness, vomiting, and fever. Rigidity of the abdomen and leucocytosis are usually present. Vomiting of purulent material is very significant when present (Sundberg, 19; Boas, 4), but is not very common. The pain closely resembles

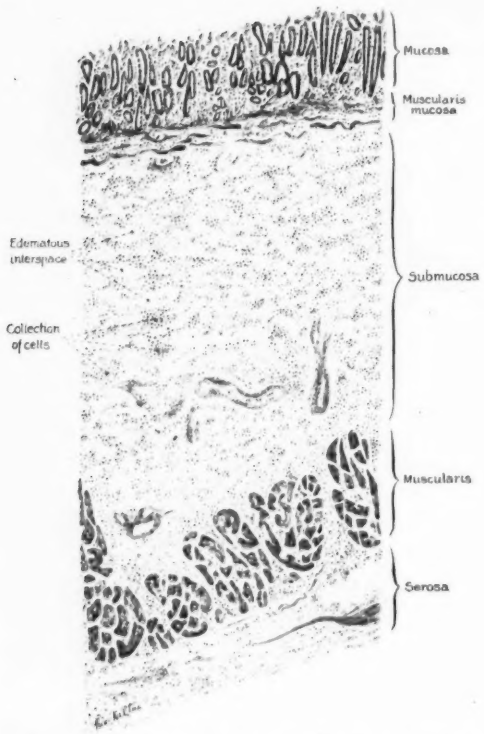

Fig. 3. Drawing of stomach wall in Case 1 under low power, showing practically normal mucosa, slightly pathological muscularis mucosæ and a markedly widened submucosa the result chiefly of œdematous infiltration and to a much less degree of infiltration with round cells. The muscularis is slightly involved and the serosa is slightly thickened.

that in perforating peptic ulcer but may be distinguished from the latter according to Sundberg by the fact that the pain in phlegmonous gastritis is relieved when the patient sits up and fever is usually present. An important feature is that the pain, vomiting, and fever are constant throughout the course which may last from 4 or 5 days to 2 weeks. The recognition of phlegmonous gastritis is very difficult but von Stapelmohr (18) claims to have made the diagnosis during life and his patient recovered after operation. More frequent and earlier recognition would undoubtedly lead to a much better chance for recovery as there are quite a number of cases of operation with recovery, among these being the cases of Novak, von Stapelmohr, Bovee, Koenig, Mikulicz, Zoeppfel, Lengemann and the two cases of Bircher. There are undoubtedly several other recoveries, the reports of which are not available to us, especially the original of the exhaustive article by Sundberg (19). Two of the recoveries mentioned above were in cases of the diffuse variety in which nearly the entire stomach was involved.

The type of operation will best be determined after the abdomen is opened. In the localized forms after resection, the stump of the stomach can be anastamosed to the jejunum. Extensive resection may be attempted in the diffuse form if there is a small portion of the cardia which is relatively uninvolved. Some surgeons have performed multiple punctures of the stomach wall in the extensive diffuse form in the hope that the ensuing drainage will be sufficient. Such a case was reported cured by Stapelmohr after the diagnosis was established when the abdomen was opened. At all events operation is the only procedure which offers a chance for recovery as the mortality in the cases not operated upon including the localized and diffuse forms is 92 per cent according to Sandelin and Sundberg.

In order to help impress the importance of recognizing phlegmonous gastritis and to emphasize the fact that recovery is possible, we wish to report in some detail the history and anatomical findings in 2 cases observed at the Cook County Hospital during the past year.

Case 1. Male, age 49 years, was admitted to the Cook County Hospital with a typical history and picture of left sided lobar pneumonia of 10 days' duration. In addition to these symptoms, there were also periodic nausea, vomiting, hæmoptysis and tenderness in the epigastrium beginning with the onset of the pneumonia. There was no history of previous digestive disturbance.

Physical examination revealed a very ill, colored patient with signs of consolidation of both lower lobes of the lungs. The epigastrium was tender but not rigid. The liver and spleen were not palpable. The temperature varied between 102.4 to 104. The urine, Widal test, and blood Wassermann were negative and a blood culture showed micrococcus tetragenus, which was probably a contamination. The white count was 22,000, hæmoglobin 80 per cent, and the blood chemistry showed urea nitrogen 26.2 mg. The patient was given one injection of

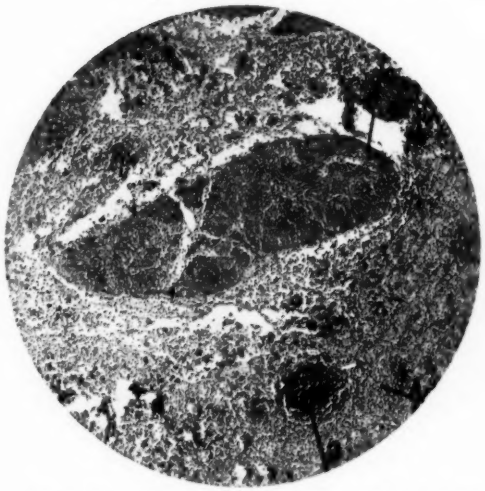

Fig. 4. Photomicrograph of specimen in Case 2 showing, *A*, infiltrated submucosa; *B*, small abscess in the submucosa; *C*, muscle bundle of the muscularis surrounded by the infiltrate.

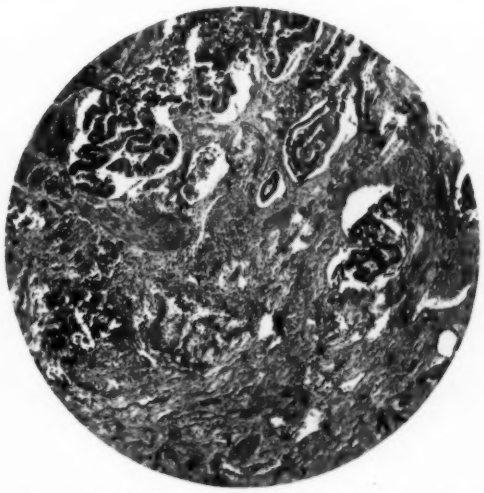

Fig. 5. Photomicrograph of specimen in Case 2 near the carcinoma showing, *A*, infiltrated submucosa; *B*, carcinomatous tissue.

antipneumococcus serum on admission but his condition grew worse and he died 9 days after being admitted to the hospital.

Autopsy was performed 4 hours after death and revealed lobar pneumonia in the early stages of gray hepatization. The peritoneum was dull, injected and covered by fibrin and the peritoneal cavity contained a fibrinopurulent fluid. The stomach was about twice the usual size, measuring 17 centimeters at its widest diameter and 53 centimeters along the greater curvature. The external surface presented a roughened, yellowish pink appearance and seemed almost translucent in several places. There were numerous visible yellowish streaks corresponding to the lymph vessels running parallel to the circular muscle fibers. A few small petechiæ were present on the serous surface along the lesser curvature near the cardia. A thin coat of fibrin covered the outer surface of the stomach and was more marked near the petechiæ at the cardia. The entire organ appeared very boggy.

The stomach was opened, and the mucosa presented a reddish hue with numerous petechiæ, especially in the region of the cardia. No ulcerations were present in the mucosa except for an occasional, fresh, linear erosion. The surface of the mucosa was smooth, œdematous, and practically devoid of rugous folds. The inflammatory swelling terminated very abruptly at the cardio-œsophageal junction and at the distal margin of the pyloric ring.

The wall of the stomach presented a striking appearance on cut section, being from 1.5 to 2 centimeters in thickness and being succulent and exuding a thin, yellowish seropurulent pus on slight pressure. The mucosa and muscularis were of normal proportions but the submucosa was enormously thickened throughout its entire extent, forming most of the entire thickness of the stomach wall. The serosa was greatly thickened in spots.

Microscopic examination showed an abrupt termination of the phlegmonous process at the œsophageal and duodenal junctions. The outstanding pathological involvement was in the submucosa which was many times the normal thickness and which showed marked œdema and considerable infiltration by plasma cells, round cells and chiefly by polynuclears. The inner layer of the muscularis also was broken up into bundles between which were large collections of leucocytes, chiefly polynuclears. There were no evidences of perivascular infiltration or miliary abscesses. The mucosa and muscularis showed comparatively little inflammatory infiltration but the serosa showed considerable fibrin on its external surface in numerous areas.

Cultures were made from the stomach wall and from both lungs and hæmolytic streptococci were obtained together with bacillus coli, the latter being probably a postmortem invader.

Case 2. Male, age 42 years, was admitted to the Cook County Hospital on January 5, 1926. The patient stated that he was perfectly well up to 5 months before admission when he began to suffer from shortness of breath, palpitation, and swelling of the abdomen and legs. He also had some belching after meals and mild epigastric distress which was relieved by bowel movement.

Physical examination at this time revealed a well nourished white male with evidences of moderate

cardiac decompensation. The liver was somewhat tender and could be palpated about one finger breadth below the costal arch. The abdomen was tympanitic, slightly tender and contained a moderate amount of fluid. A palpable mass was found in the epigastrium about the size of a walnut, hard, irregular, somewhat tender and moving with respiration. The blood Wassermann was negative as were the blood chemistry, white count and urine examination. The gastric contents showed free hydrochloric acid, none, and total acidity, 15. Blood was found chemically on repeated examination of the stools.

A diagnosis of mitral regurgitation and carcinoma of the stomach was made and corroborated on roentgenological examination. Operation was recommended but the patient went home to return nearly 3 months later in a moribund condition. The findings on his return were essentially the same as before except for a white count of 30,000, a slight fever of 101.8 degrees, and tenderness of the entire abdomen. The patient died 2 days after his second admission. Autopsy revealed pneumonia in both lower lobes, some free fluid in the abdomen, and a few flakes of fibrin were found on the serous surface of the bowel.

The stomach was almost twice the usual size and its walls were firm and very much thickened throughout the entire extent. There were adhesions about the pylorus, and the perigastric and peripancreatic lymph glands were moderately enlarged and firm. The wall of the stomach varied from 8 to 14 millimeters in thickness and exuded a seropurulent fluid on cut section. There were no gross abnormalities of the œsophagus or duodenum. The layers of the stomach wall were well demarcated, and the most marked change was in the submucosa. This layer varied from 3 to 6 millimeters in thickness, bulged out away from the muscular layer when the wall was freshly cut and was gray and moist.

Extending from the pylorus to within 5 centimeters of the cardiac sphincter, along the lesser curvature, and involving also the postèrior wall and the greater curvature was a soft, cauliflower-like fungating tumor mass. This was 8 centimeters wide and 9.5 centimeters long, and projected into the lumen of the stomach, being 1.5 to 2 centimeters thick. Its edges were well demarcated and only that portion of the gastric wall which formed its base was invaded by tumor tissue. The lesion was friable and necrotic, with a foul odor, and several small blood clots were adherent to it. The mucosa of the remainder of the stomach was somewhat mammillated and was discolored by petechial hæmorrhages, but there were no gross ulcerations or bleeding points. There were no tumor metastases except in the neighboring lymph glands.

Because of the duration of time between death and autopsy, no postmortem bacteriological studies were attempted.

Microscopic examination of a section removed from the border of the tumor of the stomach revealed hyperplasia of the glands of the mucous membrane, and the proliferation and infiltration of atypical glandular and tubular elements into the submucosa and muscularis. The superficial portions of the tumor were necrotic and structureless, and the whole was markedly infiltrated with inflammatory cells. No evidence of carcinoma was found in the wall of the stomach in any other portion except at the base of the tumor mass.

Sections removed from the cardiac portion of the stomach wall revealed a diffuse infiltration of polymorphonuclear leucocytes and plasma cells. This was most marked in the mucosa and submucosa, particularly the latter, where the inflammatory cells were frequently clumped together to form mycotic abscesses, some of which were almost as large as the low power field.

Some of these abscesses were around larger blood vessels and gave the impression that they represented the site of dilated lymph spaces by which the infection had spread. The actual demonstration of lymphatics could not be made.

The bundles of the muscular layers were widely separated by a finely granular, albuminous exudate and some of them had lost their usual staining properties, were swollen, and appeared necrotic and fragmented. The serosa was thickened and covered by a thin fibrinous membrane. The muscularis mucosa was fairly intact except for the changes mentioned and the lymphoid follicles below it were enlarged and their borders poorly defined.

RÉSUMÉ

1. Two cases of phlegmonous gastritis are reported in order to emphasize the fact that this condition is not as rare as it is ordinarily supposed to be.

2. There are several reports in the literature of cases of both the diffuse and localized varieties in which operation was followed by recovery.

3. The condition may be due to a bacteræmia or extension from a focus elsewhere in the body or may be associated with a local pathological condition in the stomach. Our two cases were examples of each of the two ways in which this condition may arise.

4. The essential pathology consists of a seropurulent infiltration, chiefly of the submucosa, associated with considerable round cell involvement of this layer. The process may be localized or diffuse, involving the entire stomach but ending abruptly at the œsophageal and pyloric orifices.

5. The gross appearance is that of a very much thickened stomach wall which is very

boggy, exudes pus from the cut section and in which the mucosa is usually intact.

6. The clinical picture combines the features of the so-called "acute surgical abdomen" with the phenomena of generalized sepsis.

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FIBROMYXOSARCOMA OF THE STOMACH IN A CASE OF NEUROFIBROMATOSIS (VON RECKLINGHAUSEN'S DISEASE)

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THE occurrence of sarcoma arising in a neurofibroma in the gastro-intestinal tract of patients having von Recklinghausen's disease is sufficiently rare to justify recording the following interesting example. So far only four such cases have been described.

Von Recklinghausen (4) recorded an instance in which, in addition to the typical lesions described in multiple neurofibromatosis, there were in the intestinal tract two sarcomata: one in the wall of the stomach, the other in the wall of the jejunum. From their appearance he concluded that these were malignant tumors which had arisen in previously benign neurofibromata.

Adrian (1) reported a case of multiple neurofibromatosis in which there was found at the junction of the ileum and jejunum a benign neurofibroma. There was also found in the duodenum a walnut-sized tumor which on microscopic study proved to be a sarcoma.

Herxheimer and Roth (2) quoting Cohts, stated that numerous neurofibromata were found in the subserosa of the stomach and small intestine, and that in the duodenum there was found a sarcoma which they concluded had its origin in a neurofibroma.

Shouldice (3) reported a case of multiple neurofibromata in which there was a large tumor of the stomach. The microscopic diagnosis was fibromyxosarcoma. There were no metastases and the patient was reported in good health 2 years following partial resection of the stomach.

There have been many cases reported of sarcomatous degeneration of the tumors in the skin or of the nerves with formation of metastases elsewhere. The number of cases of benign neurofibromata of the intestinal tract are, however, very few, and sarcomatous degeneration occurs even less often.

The following case presented the characteristic picture, as described by von Recklinghausen, of multiple neurofibromata of the skin and subcutaneous tissues, associated also with a huge fibromyxosarcoma of the stomach. This gave the appearance of having had its origin in a benign neurofibroma. There were no glandular metastases but definite metastatic nodules were present on the peritoneal surfaces of the diaphragm and liver.

History No. 148818, Lane Hospital. An Italian laborer, age 48, admitted to the hospital February 23, 1926, had noticed for 2 months a gradually increasing mass in the upper abdomen. There had been an increasing weakness for 5 months with a loss in weight of 14 pounds. He complained also of pain in the left upper quadrant with a sensation of fullness after eating which was relieved by vomiting. There had been some diarrhœa. The patient stated further that the numerous pigmented spots and soft subcutaneous nodules scattered over the chest, back, and forehead, had been present as long as he could remember, and had never given any trouble. There was no history of similar lesions in other members of the family.

Physical examination revealed extreme emaciation. There were scattered over the entire body,

Fig. 1. Sagittal section of tumor, stomach and ulcer showing 3, wall of stomach; 6, ulcerating mass of sarcoma projecting into cavity of stomach; 7, point at which cavity of ulcer is continuous with cavity in body of tumor; 8, large area of degeneration, 9, destruction of posterior wall of stomach by extension of tumor.

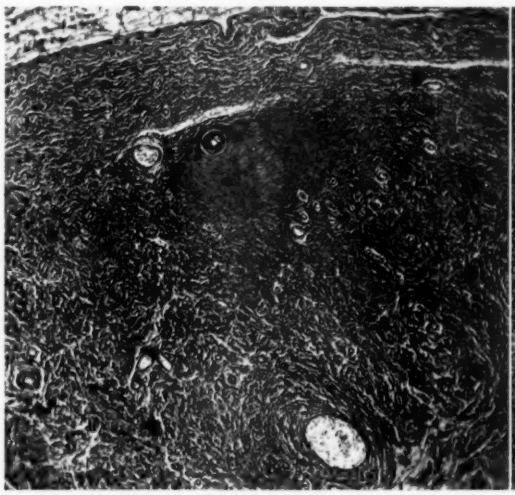

Fig. 2. Photomicrograph showing pathological histology of a cutaneous nodule (neurofibromatosis).

Fig. 3. Photomicrograph showing pathological histology of abdominal tumor (fibromyxosarcoma).

including the head, many soft, subcutaneous nodules, which were freely movable, well circumscribed, and regular in outline. In the skin were numerous pigmented spots, brownish in tint, some of them as small as freckles, and some with a diameter of 1 to 2 centimeters.

In the abdomen was a painless, large, irregular tumor visible in the left side of the abdomen, which seemed to move up and down on respiration, and which apparently was neither liver nor spleen. It extended from underneath the left costal margin to the level of the anterior superior spine, and crossed the midline to the right. No other abnormalities were found.

Special examinations revealed a negative Wassermann reaction, an achlorhydria, and a secondary anæmia. The blood had a hæmoglobin of 45 per cent, the red cells numbered 3,600,000, and the white cells 15,650, of which 70 per cent were polymorphonuclear leucocytes, 28 per cent lymphocytes, and 2 per cent transitionals. Examinations of the stool and urine were negative. A nodule removed from the chest wall proved to be a neurofibroma. A roentgen-ray examination following a barium enema indicated that the tumor lay outside the colon but did not reveal its identity.

A probable diagnosis of retroperitoneal fibrosarcoma secondary to von Recklinghausen's multiple neurofibromatosis was made by Dr. William Dock, and an exploration was undertaken on February 27, 1926, by Dr. Emile Holman. The tumor was freely movable in the abdomen, and lay between the stomach and the transverse colon, to both of which it was intimately attached. No metastases were demonstrable. Its removal necessitated a resection of approximately four-fifths of the stomach and an 8-inch section of the transverse colon. An end-to-end anastomosis of the large bowel, and a Pólya-Balfour procedure re-established the continuity of the gastro-intestinal tract. The patient was fairly comfortable for a week following the operation, but then developed signs of a generalized intra-abdominal infection, including hiccoughing, vomiting, fever, and a diarrhœa. These signs and symptoms persisted and he died on the eighteenth day following operation.

An examination of the tumor removed at operation revealed a large mass measuring 23 by 26 by 12 centimeters, which was lobed and lobulated, some of the more prominent lobules being cystic. It appeared to have grown from the posterior surface of the stomach downward and forward into the great omentum, and the transverse colon lay on its posterior surface. A longitudinal incision of the stomach along the lesser curvature exposed in the posterior gastric wall a prominent ulcerated growth measuring 8.5 by 6 centimeters in diameter. The edges were thick, raised, and soft. The finger could be inserted for a distance of 6 centimeters into a cavity, evidently through the posterior wall, into the body of the tumor.

Microscopic examination of the tumor revealed an œdematous and more or less myxomatous stroma infiltrated abundantly with cells of small and large nuclei. A few scattered giant cells were seen. The enlarged lymph nodes did not show any metastases. A microscopic diagnosis of fibromyxosarcoma was made, with ulceration into the stomach.

A necropsy was performed by Dr. J. Oliver on March 17, 1926. The base of the laparotomy wound

was covered with a greenish purulent material. The bottom of the wound was made up of small intestines glued together with adhesions. The peritoneal cavity was almost completely obliterated by adhesions, except in the flanks and in the pelvis where there were present about 100 cubic centimeters of greenish purulent material. The openings between the stomach and jejunum, and between the anastomosed ends of the transverse colon, were patent, and there was no sign of leakage. The liver was small.

Scattered over the anterior surface of the right lobe were several white flat nodules. They lay incased beneath the capsule and did not extend into the liver substance. On the lower surface of the diaphragm on the right were many similar white, flat nodules, the largest about 1 centimeter in diameter. Two similar nodules were found on the left diaphragm. Frozen sections showed these to be spindle-cell sarcomata similar in appearance to certain sections of the original tumor. The retroperitoneal lymph glands were small. The spine and the bones of the pelvis were free of tumor. The heart was normal. Both lungs showed healed apical scars and marked congestion of both bases with bronchopneumonic patches.

SUMMARY

A case of multiple neurofibromatosis associated with an intra-abdominal sarcoma is presented. This presumably arose in a neurofibroma of the stomach wall. The presence of a rapidly growing intra-abdominal tumor associated with von Recklinghausen's disease should, therefore, suggest the possibility of sarcomatous degeneration of a previously benign neurofibroma.

I am indebted to Dr. F. E. Blaisdell, Sr., for the preparation of the photomicrographs appearing in this article.

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TORSION OF THE SPERMATIC CORD

Report of Fifteen Cases[1]

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TORSION of the testicle, or more properly, torsion of the spermatic cord, describes the character of this condition. There is an axial rotation or twisting of the cord itself with cutting off of the blood supply to the testicle and epididymis with concomitant local and, in acute cases, systemic symptoms. The twist may occur in either direction.

The relatively few cases reported in the literature is not a true index of the incidence of this lesion. Prior to 1920 there were but 120 cases recorded. Since that time 17 have been added. Seven of these were observed in Bellevue Hospital and reported by Keyes, Collings, and the writer. To these we wish to add 8 cases studied in the past 3 years, making a total of 15 seen in Bellevue in 6 years. Unquestionably, many cases diagnosed epididymitis or orchitis, subsequently subsiding, pass unrecognized. Also, many operations have been performed for unexplained gangrene of the testicle which were probably torsion, because the site of twist (within the tunica vaginalis just above the epididymis) is not borne in mind.

The etiology of this twist has not been definitely determined. In practically all cases, congenital malformation of one form or another has been observed. The chief predisposing cause is abnormal mobility of the testicle. Owen has demonstrated that a testicle normally placed with a normal mesorchium cannot be twisted. Nearly half of the patients give a history of imperfectly descended testicles on the affected side. In our series, notes were made that the gubernaculum was unusually long and lax in four cases, absent in four. Rigby and Howard (2) mention other anomalies as a spacious tunica vaginalis, elongation of the globus minor, or an abnormal attachment of the mesentery and vessels to the lower pole of the testicle and to the globus minor, resulting in the testicle being attached by a narrow pedicle rather than by a broad band.

While the exciting cause may be unknown, as in five of our Bellevue cases, sudden muscular effort or violent straining is the most frequent immediate antecedent of the condition. It was present in half of our cases. Once the condition resulted from a squeeze of the testicle (Case 5). Particularly has sudden cremaster contraction been emphasized. On the other hand, three cases reported elsewhere have occurred during sleep (3) as in one instance in this series. Three-fourths of those affected are young adults, most of whom are under 20 years. Our youngest was 15; the oldest 49. The condition has been observed in infants.

Onset of acute torsion is sudden, with exquisite pain in the testicle followed by localized swelling. Often there is elevation or drawing up of the organ, perhaps due partly to shortening of the cord by twist, but more probably resulting from reflex cremaster contraction incited by inflammation. Nausea, vomiting, chills, fever, and, not infrequently, lower abdomen pains ensue. These pains are usually referred in character, originating in the spermatic cord.

The syndrome in many respects resembles strangulated hernia, from which condition it must be differentiated. Pain and swelling may be delayed, and the patient postpones his search of relief. Both local and systemic symptoms may be severe to the degree of prostration. The temperature in uncomplicated cases is rarely above 100 degrees F. In severe cases it may reach 104 degrees F. Asymptomatic torsion has been noted.

With the onset of gangrene, pain becomes diminished and may disappear altogether. In unoperated cases not becoming gangrenous, the early acute tenderness subsides in time, but the testicle may remain highly sensitive to deep pressure for many weeks.

Relapsing torsion resembles the acute exacerbation of a chronic epididymitis and is

[1] From the Urological Service of Bellevue Hospital.

Fig. 1. Case 1. Torsion of the cord just above the epididymis. Orchidectomy 8 days after onset of pain in testicle.
Fig. 2. Section of epididymis and testicle, Case 1, showing gangrene and hæmorrhagic infiltration.

of relatively brief duration, lasting but a few hours. A patient of Van der Poel learned to relieve himself by untwisting his cord (4). This condition does not give rise to systemic symptoms.

When the involved organ is in the inguinal canal, as many are, both local and generalized symptoms are exaggerated. Frequently there is a localized peritonitis, which complication renders the diagnosis still more obscure. Torsion of an ectopic testicle in the inguinal canal may give all the symptoms of strangulated hernia save absolute obstipation and fæcal vomiting. Vomiting with tympanites may be present. The condition of the patient may be extreme and warrants immediate exploration.

The correct diagnosis of torsion of the spermatic cord is rarely made without exposure of the testicle and cord, although the probable diagnosis can be made if one will but bear the condition in mind. Two physicians who had seen some of our torsion cases in Bellevue have each since correctly diagnosed two cases in their private practices.

As has been pointed out, the occurrence of an "epididymitis" in a youth who presents no evidence of urethral infection, is highly suggestive of torsion. Particularly is this so with a history of a freely movable testicle or evidence of a long gubernaculum on the opposite side. Indeed, many patients will state that the testicle has often disappeared in the region of the external inguinal ring, or has given other evidence of abnormal mobility. In questioning the patient it is well to bear this in mind (see Case 4). Furthermore, there may have been an antecedent attack, as with three of our patients (see Cases 12, 13, and 14).

The spermatic cord above the attachment of the tunica vaginalis is usually normal, as are the prostate and seminal vesicles. Ancient or recent urethral infections may confuse the diagnosis. In one of our cases, previously reported, a recent gonorrhœa was misleading (Case 3).

Inspection reveals evidence of acute localized inflammation. If the testicle is in the scrotum, the skin is markedly reddened, and the visual evidences of inflammation (redness, œdema, and swelling) usually extend well beyond the midline. In the early stages, palpation discloses an acutely tender mass in which it is impossible to differentiate epididymis from testicle. The cord above the twist is normal. There may be evidence of fluid within the vaginalis. In the presence of gangrene, the involved organs are relatively insensitive.

Palpation of an involved testicle in the inguinal canal is unsatisfactory. Differentiation from hernia, neoplasm, or epididymitis is quite impossible. In one of our cases diagnosed as torsion, the patient presented bilaterally undescended testes with a tender, hen's egg size mass in the left groin, hydrocele

Fig. 3. Case 2. Twist occurring in cord just proximal to junction with epididymis. Orchidectomy for gangrene 16 days after onset of pain.

Fig. 4. Case 12. Three-quarter twist at vaso-epididymal junction. Orchidectomy for gangrene 9 days after onset of symptoms.

fluid presenting anteriorly. This had been noted 10 days. Urethral smear showed gonococci. Torsion and epididymitis were considered. Operation disclosed neoplasm.

The diagnosis of torsion depends chiefly upon the acuteness of onset and severity of symptoms, the latter showing a tendency to diminish with the progress of the disease in the absence of other evidence of acute inflammation. In its inception, epididymitis is rarely so excruciatingly painful as torsion. Strangulated hernia is a lesion of later life, and its course is one of progressive severity.

As a rule the twist occurs just above the testicle and is within the tunica vaginalis. The proximal cord is normal or only slightly œdematous. The distal is discolored, bluish black or gangrenous, as are the testicle and epididymis. Usually there is some serosanguinous exudate in the vaginalis, said by some to be pathognomonic. Section reveals generalized thrombosis of the involved cord below the twist; the testicle and epididymis resemble an organized blood clot. The microscope may disclose hæmorrhagic infarction, interlobular hæmorrhage or atrophy. Gangrene or atrophy is reported in 86 per cent of those cases not relieved immediately. Our experimental work on dogs demonstrated that gangrene occurs within 48 hours (1).

If operated upon before gangrene has ensued, the testicle may be saved in many instances, but it will atrophy. An involved testicle has been known to disappear totally.

Torsion may be prevented by operating upon undescended testes before puberty, the organ being well sutured to the bottom of the scrotum. The mate of an involved scrotally contained testicle is often found to possess abnormal mobility and we have in five cases sutured this testicle to the depth of the scrotum after performing an inversion of the tunica vaginalis to prevent hydrocele. Unwinding the unexposed testicle is a blind

procedure, particularly as the direction of the twist is not known. Nash (5) performed this successfully one hour after onset, but the organ subsequently atrophied. The diagnosis being made, expectant treatment with suspension ice cap, rest in bed, etc., is ill-advised. Gangrene may ensue, whereas immediate delivery and unwinding of the testicle, with proper replacement and suture, will save many of these organs and atrophy will assuredly be lessened. Untwisting and fixation likewise is indicated in mild cases.

If the testicle and epididymis are viable, as indicated by bleeding on incision, and there is no bluish-black discoloration, the cord should be untwisted, the tunica vaginalis inverted and the organ sutured to the bottom of the scrotum. This we did successfully three times. If the testicle is not viable, orchidectomy should be performed. No deaths are reported.

CASE REPORTS[1]

CASE 1. J. G., age 23 years, admitted to Bellevue September 18, 1920. Five days before, while doing heavy lifting, he noted a sudden sting in the left testicle with subsequent enlargement. He was in bed 4 days at home. September 21, 1920, orchidectomy was done for torsion. Early gangrene was found. The twist was ½ inch above the vaso-epididymal junction. Uneventful recovery.

CASE 2. S. B., age 15 years, was admitted to Bellevue December 22, 1919. Eight days previously, while playing basket-ball, he suffered a sudden sharp pain in the right scrotum with subsequent swelling. Enlargement and pain were constant. Operation was done December 30, 1919, orchidectomy for gangrene. A 360 degree twist was found just above the vaso-epididymal junction. Uneventful recovery.

CASE 3. P. S., age 23 years, was admitted to Bellevue September 9, 1920. He had had a swelling of the right testicle 7 years. No injury was known. Gonococci were found in urethral smears. Diagnosis: gonococcus epididymitis. Operation October 19, 1920. No gubernaculum present, twist of cord was found just above the testicle, partial gangrene of testicle. Orchidectomy. Uneventful recovery.

CASE 4. M. M., age 16 years, was admitted to Bellevue, March 25, 1921. While carrying a heavy basket he noted a sudden sharp pain in the right testicle followed by swelling of the part. He gave a history of both testicles going to external ring easily. Operation March 3, 1921. Testicle was enlarged with marked congestion of vessels beneath the tunica albuginea. No evidence of epididymitis was found nor twist of cord. Gubernaculum was 3 inches long. Both gubernaculi were plicated. Uneventful recovery.

CASE 5. G. McN., age 15 years. Patient of Dr. A. Raymond Stevens, seen December 20, 1920. Testicles were squeezed by another boy 12 days previously. The left testicle was enlarged and acutely inflamed. Operation December 21, 1920. Gangrene of testicle and epididymis with twist of cord above testicle more than 360 degrees were disclosed. Orchidectomy. Uneventful recovery.

CASE 6. V. F., age 16 years, was admitted to Bellevue May 2, 1921. Twenty hours before admission patient jumped and felt pain in left scrotum, followed by enlargement and pain. Operation May 3, 1921. Early gangrene of cord extended high into the inguinal canal. A segment of 2 inches of œdematous, gangrenous appearing vessels of cord was excised, care being taken to maintain the continuity of the vas. Ferguson repair. Uneventful recovery. Six months later both testicles felt normal.

CASE 7. L. A., age 23 years, was admitted to Bellevue January 23, 1922. Cramplike pain was felt in abdomen 3 hours before admission. He was nauseated but did not vomit. The right testicle was half way down in the inguinal canal, and was swollen and tender. Operation January 23, 1922, disclosed early gangrene of undescended testicle. The cord was twisted once and a half times at the internal ring. Orchidectomy. Bassini repair. Uneventful recovery.

CASE 8. S. C., age 32, was admitted to Bellevue November 6, 1922. While jumping from a horse to a steer, the horns of the steer struck him in region of the testes. He lost consciousness. He later found the left testis swollen with blood oozing from meatus. He entered the hospital. He had just completed treatment for gonorrhœa. The left testicle was three times normal size; tender on pressure. There was a small perineal swelling. Blood was oozing from the meatus. Rectal examination was negative. Operation, November 9, 1922. A small amount of fluid was found in the tunica vaginalis. The epididymis was somewhat enlarged but not indurated throughout course. Multiple puncture was revealed. No pus. The testicle was noted to be blue; cut into; no bleeding; pale color. Cord was slightly twisted above testicle. Orchidectomy for gangrene. Uneventful recovery.

CASE 9. S. C., age 19 years, was admitted to Bellevue December 4, 1922. One year ago he noted a slight pain in the right testicle. He had little trouble until 1 month ago when pain increased and swelling developed. Now he has occasional sharp and vague pain in the right scrotum. Previous genito-urinary history was negative. Physical examination showed the abdomen to be tense, with very slight tenderness to deep palpation to right kidney anteriorly. The right epididymis was hard and slightly tender at upper pole anteriorly. Rectal examination was negative. Operation, December 5, 1922. Orchidectomy for gangrene. Upon incision testicle untwisted. Uneventful recovery.

[1] Cases 1 to 7 abstracted from previous report; Cases 5, 6 and 7 are reported through courtesy of Drs. A. Raymond Stevens, Bradley Coley, and Fenton Taylor, respectively.

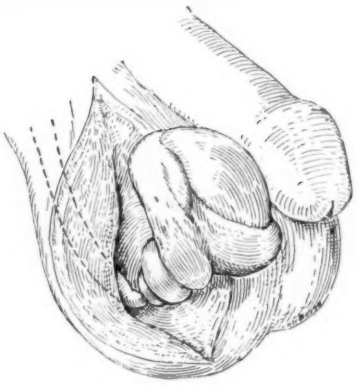

Fig. 5. Case 13. Two complete turns of cord with gangrene of testicle and epididymis. From sketch at time of operation.

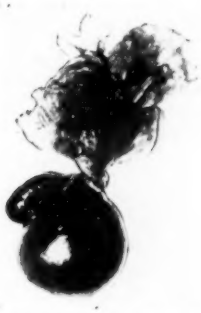

Fig. 6. Gangrene of testicle and globus minor. The globus major of the epididymis passes through twist to become part of the tunica vaginalis. Orchidectomy for gangrene.

Case 10. A. T., age 17 years, was admitted to Bellevue November 15, 1924. One week ago left scrotum began to swell; no injury. Once, 2 years previously, he noted slight bleeding from the urethra. Swelling has never been unduly painful. Previous genito-urinary history was negative. Physical examination disclosed a slight serous discharge. The left epididymis seems twice normal size and is slightly tender. The cord is swollen and somewhat tender throughout course. The prostate is normal. Operation: The left tunica vaginalis was opened. Adhesions were found everywhere. The testicle was dark brown, felt softer than normal. Cut surface. Epididymis bleeds. A serosanguinous fluid escapes from the cut testicle, but latter organ was thought to be viable. Acute torsion was not found, although course of cord showed some rotation. The vessels of the cord below external ring were partly thrombosed. Gubernaculum was lax. The testicle was sutured to the bottom of the scrotum. The other testicle was sutured to the bottom of the scrotum also. Uneventful recovery.

Case 11. F. K., age 49 years, was admitted to Bellevue Hospital November 25, 1924. Four days ago the right testicle became swollen, then painful, and enlarged; painful on motion. Past genito-urinary history was negative. Physical examination revealed hypospadias; scrotum œdematous, enlarged; both epididymis and testicle seem to be involved; cord not much thickened and not tender; prostate normal. Operation, November 28, 1924. Tunica vaginalis was opened on right side. Considerable bloody fluid was evacuated. The testicle and epididymis were black. The cord showed three complete turns above the testicle. Orchidectomy. Uneventful recovery.

Case 12. F. M., age 23 years, was admitted to Bellevue October 29, 1925. Eight days before admission he noted pain and swelling of left testicle. Condition has not changed. No history of injury. Two years before he had slight swelling of left testicle which lasted about half a day. Previous genito-urinary history was negative. Physical examination revealed left scrotum greatly enlarged, skin tense, uniform consistency, suggesting fluid; testicle and epididymis not definitely defined; cord is thickened; vas enlarged and tender; prostate normal; vesicles not enlarged. Operation, October 30, 1925. Vaginalis contains small amount of bloody fluid. Testicle and epididymis deep, dusky red, almost black. Three-quarter twist above testicle. Orchidectomy for gangrene. Uneventful recovery.

Case 13. J. B., age 23 years, was admitted to Bellevue February 26, 1926. Patient noticed swelling and pulling sensation in scrotum 6 days ago, later finding left testicle swollen. Pain was neither acute nor severe; no nausea nor vomiting; swelling gradually increased. No treatment was given except suspensory. Two years ago patient noted similar pain in this testicle, subsiding in 36 hours without treatment. Venereal disease denied. Physical examination showed left scrotum occupied by doughy painless mass, the size of a large lemon; no œdema or tenderness of scrotal skin; vas thickened, slightly tender; no fluctuation. Absence of normal testicular sensation noted; prostate and seminal vesicles normal. Diagnosis: Torsion of spermatic cord. Operation, February 26, 1926. Upon opening the tunica, blood-tinged watery fluid escaped. Epididymis was black. The testicle was soft, suggestive of abscess. Two complete turns of the spermatic cord were found just above the epididymis (Fig. 5). Gubernaculum was normal. Mesorchium seemed longer than normal. Testicle was unwound and replaced in scrotum, hoping to revive it with hot dressings. Six days later definite evidence of testicular gangrene were found. The old wound was opened. Orchidectomy was performed. The testicle was necrotic with no evidence of normal tissue. Uneventful recovery.

Case 14. F. G. was admitted to Bellevue April 12, 1926. Four days previously he was pushed

against a subway gate. He noticed no pain at this time. The following morning he found the left testicle swollen and acutely tender. He vomited once. The pain had subsided somewhat in past 24 hours. Venereal disease was denied. He had had occasional sharp pains in the left testicle in recent years. Physical examination showed the left scrotum three times normal size. The contents were acutely tender but could not be differentiated. External enlarged ring, but no hernia present; cord normal. Rectal examination showed findings normal. Operation, April 13: Tunica vaginalis contained bloody fluid; testicle black; no gubernaculum found; epididymis attached with vessels of cord only at globus minor, the globus major passing upward in cord and laterally to become a part of the tunica vaginalis. There was one complete revolution (360 degrees) of cord through middle of epididymis just above the testicle (Fig. 6), so that testicle and globus minor were gangrenous, proximal cord and globus major normal. Orchidectomy was done for gangrene. The right testicle was sutured to the lower pole of the scrotum. Uneventful recovery. Section of the testes and epididymis revealed hæmorrhagic gangrene.

Case 15. L. S., 18, admitted to Bellevue May 4, 1926, complaining of sudden attack of pain in left testicle 6 hours previously. Patient was awakened from sleep by acute testicular pain, agonizing in character and persisting until relieved by manipulation—untwisting in a clockwise direction one turn. He vomited once. He had had no previous similar attacks but stated that the left testicle had at times spontaneously retracted into inguinal canal. Venereal infection was denied. Physical examination revealed a normal sized but slightly tender left testicle with a small amount of fluid in the tunica vaginalis. The epididymis was found anterior, the testicle behind indicating a 180 degree twist which was relieved by a half turn clockwise with a sudden cessation of pain. Operation was done May 6; through a low inguinal incision, the cord was identified and with traction the testicle was pulled free into the wound. This demonstrated clearly the entire absence of the gubernaculum. The tunica vaginalis was opened and a small amount of fluid was liberated. The lower end of the epididymis was found to be a so-called floating tail, there being no attachment between the epididymis and the testicle. While the cord was not twisted at the time of exposure (had been untwisted pre-operatively), the epididymis particularly was bluish, the testicle less so. The testicle was sutured to the bottom of the scrotum. This case is of particular interest, it being the second recorded instance of successful manual untwisting of the spermatic cord. There are but three other recorded instances in which the condition came on during sleep.

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NEPHROLITHIASIS—A CLINICAL STUDY OF SEVENTY-ONE CASES[1]

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THANKS to the cooperation of my colleagues of the Cook County, Michael Reese, and Chicago Memorial Hospitals, I have had an opportunity to observe seventy-one cases of renal calculi and to operate in most of these cases. Although this number is relatively too small to be of much value for statistical purposes yet the cases constitute a perfect cross section of the subject from a pathological and clinical point of view.

With as little reference as possible to individual cases, I can best utilize the material by discussing it under the following four headings: causes of recurrence; diagnosis; indications for operation; technique and postoperative complications. Let us consider these in the order named.

CAUSES OF RECURRENCE

1. *Persistence of infection after operation.* It cannot be denied that in the past, a fairly large number of recurrences were due to calculi being overlooked either as the result of faulty methods of diagnosis or of operative technique. With the practical elimination of these two factors there still remain a certain percentage of cases in which calculi are being overlooked and a larger one in which they unquestionably reform. The latter as a cause of recurrence is illustrated in the following cases.

Case 1. Male, aged 40, was seen during an attack of severe right pyelonephritis (high fever, rigidity, and pain). History showed operation for kidney stone elsewhere 18 months before. There was a shadow over the right kidney area. At operation evidences were present of acute exacerbation on chronic pyelonephritis with a large soft phosphatic calculus completely filling a small thick-walled renal pelvis (Fig. 1).

Case 2. Boy of 22 was first seen at the age of 18. Marked pyuria with recurrent colicky attacks, and multiple shadows over both kidney areas were noted. Seven phosphatic calculi were removed from the right and 14 from the left kidney. There was such poor function on both sides that nephrectomy on either side was impossible. Two years later a similar number of calculi were removed by another operator. At re-examination by me about 18 months after this second operation, there were equally as many but larger shadows over both kidney areas as were present before operation. (See A of Fig. 2.)

In two more recent cases of bilateral renal calculi we advised against operation because in one (B of Fig. 2) none of the calculi blocked the pelvic outlet. In a second one we removed such an obstructing calculus[2] (under regional anæsthesia) with some improvement of the function of the corresponding kidney. These 4 patients are "chronic stone formers" in whom the infection persists and is the most important factor in the etiology of early recurrence.

2. *Persistence of inflammatory dilatation or of thickening of the renal pelvis.* Another cause so often overlooked or not sufficiently appreciated is the result of anatomical changes in the walls of the ureter and renal pelvis, as illustrated in the next case.

Case 3. Male, aged 50. The shadow over the right kidney "included" in a pyelogram, showed marked dilatation of the calyces (C of Fig. 3). A calculus was removed by a colleague about 2 months before the patient was seen on account of persisting sinus. A pyelogram revealed the same condition (D of Fig. 3) as that present before pyelotomy. At secondary operation, marked periureteritis and peripyelitis were found to be the cause of the persistence of purulent discharge from the sinus.

3. *Mechanical obstruction or muscular atony distal to the kidney.* Another cause of recurrence (reformation) of calculi is illustrated in the following cases:

a. Ureteral strictures. We have observed six cases associated with renal or ureteral calculi.

Case 4. Female, aged 40. The narrowing (Fig. 4) was just below the outlet of the renal pelvis and the walls of the ureter were very rigid and thick. A large calculus was found in the pelvis proper and several smaller calculi in dilated calyces. One was found free in the perinephritic tissues and a second was about to be extruded (Fig. 4). Streptococcus hæmolyticus was isolated in pure culture from the renal pelvis. The degree of intrarenal tension can be easily visualized from the fact that two calculi were expelled spontaneously into the surrounding tissues. In this case only nephrectomy could be considered.

[2] The indications for operation in bilateral calculi are considered under the heading, "Indications for Operation."

[1] Read at the May 7, 1926, meeting of the Chicago Surgical Society.

Fig. 1. Kidney from case of recurrence of phosphatic calculus 18 months after previous operation. Note large calculus almost completely filling renal pelvis whose thick walls are visible. Parenchyma shows acute pyelonephritic changes.

Case 5. Male, aged 55, came with hæmaturia and left kidney pain. Multiple left calculous shadows (B of Fig. 5) were noted. Marked stricture in the lower portion of the lumbar ureter could be seen in the ureterogram (A of Fig. 5) and this was confirmed by the passage of bougies. The calculi were removed. The chief object of the postoperative treatment will be dilatation of the stricture and lavage of the renal pelvis in order to prevent recurrence.

We have had 4 additional cases of ureteral stricture in which calculi were found either firmly impacted at the site of the stricture or immediately above it. In one of the latter the shadow of the calculus was seen in the kidney area some months before it became obstructed at the site of the ureteral stricture.

b. Injury of spine with resultant paraplegia. The influence of atony due to spinal cord disease or injury in favoring infection and resultant stone formation in the kidney was seen in Case 40 in which a fracture of the spine 5 years before with paraplegia was followed by urinary retention. One kidney revealed a large branching calculus with complete loss of function.

c. Abnormal mobility of the kidney, faulty ureteral inserts, etc. In 2 cases there was very marked abnormal mobility of the kidney. One can readily understand how this would favor stagnation and resultant calculus formation. The same is true of faulty implantation of the ureter. In our second case (Fig. 9) of horseshoe kidney, we removed by pyelotomy 4 large calculi from the left half. About 6 months later radiography revealed a number of smaller shadows on the same side. The patient died shortly afterward of a miliary tuberculosis and at autopsy we found this left pelvis filled with calculi. The ureter arose from a point on the anterior aspect of the renal pelvis which was at least an inch higher than the lowermost portion of the pelvis.

d. Obstructions at the vesical neck. Our experience with 4 cases of renal calculus, 2 in young men and 2 in older individuals, have impressed us with the necessity of a routine radiographic examination of the entire urinary tract as a part of our preparation of cases of vesical neck obstruction in elderly persons as well as the advisability of a search for contractures of the bladder outlet and urethral

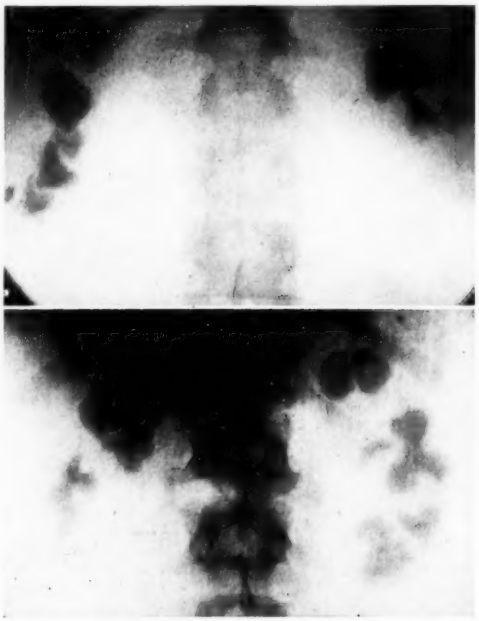


Fig. 2. A. Multiple bilateral shadows 2 years after two nephrotomies. B. Multiple bilateral shadows in which operative interference was contra-indicated because none of the calculi blocked the pelvic outlet. (Compare with Fig. 14.)

stricture of congenital origin in children and young adults who have chronic pyelonephritis with recurrent calculus formation.

(e) Urethral strictures. In 2 of our cases we feel that this condition played an important part in favoring bladder and renal nfection and urge the necessity of recognition of such a factor if we wish to reduce to a minimum the causes of reformation of calculi.

Late Recurrences. Three cases illustrate a point which is of interest in estimating the value of follow-up records of recurrence after renal calculus operations. In 2 the patients had no symptoms for 10 years after the primary operation and in a third case calculi were found in the ureter and kidney of one side, 11 years after removal of calculi from both kidneys.

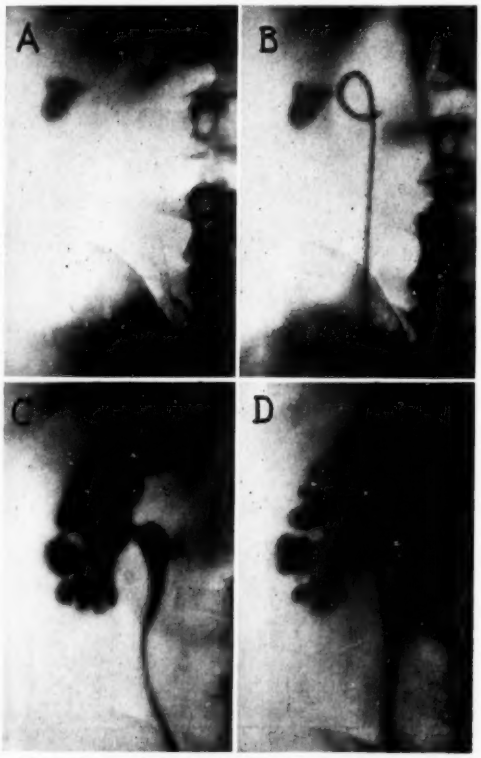


Fig. 3. Series of views before and after pyelotomy. A and B. Shadow without and with opaque catheter. C. Pyelogram before operation showing calculus lying in renal pelvis with greatly dilated calyces. D. Pyelogram from same case 2 months after operation. Note persistence of dilatation.

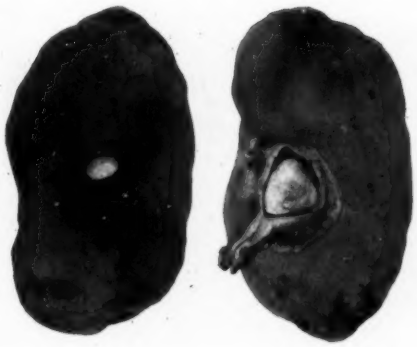


Fig. 4. Surface and sectional views of kidney showing large calculus blocking pelvic outlet. Note thick-walled ureter just below this obstruction with marked narrowing of lumen. On surface one can see a calculus being expelled into perinephritic tissues. Case seen in consultation and operation performed with Dr. P. S. Clark.

DIAGNOSIS

We are concerned in a given case of renal calculus with the following: (a) Does the clinical picture correspond to what we have been taught is typical of this condition? (b) Is the shadow that of a renal calculus? (c) What is the condition of the involved kidney and of the opposite one?

Let us consider these in the order named:

Clinical pictures. A study of a large number of reported cases and a survey of our own leads to the conclusion that no single symptom or group of symptoms is pathognomonic of renal or ureteral calculi. The diagnosis must rest more upon the objective findings which a urological study yields than upon the clinical history, although the latter is of great assistance.

In Figure 6 we have grouped the various clinical pictures under which nephrolithiasis presented itself in our cases. It will be noted that pain of a colicky or more localized character constitutes a fairly large percentage. Formerly the colics, which are such a striking feature of many cases, were thought to be typical for calculous disease alone but we now know that colics of equal severity are seen in chronic nephritis, in renal and ureteral infection, in "dropped" kidney, in ureteral strictures, tabes, passage of clots and in showers

Fig. 5

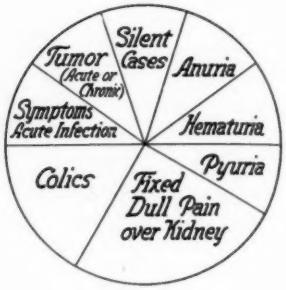


Fig. 6

Fig. 5. A. Bilateral ureteropyelogram from case of multiple calculi in pelvis and calyces of left kidney. B. Note stricture in iliac portion of ureter of left side.

Fig. 6. Relative frequency of various clinical pictures in nephrolithiasis (see text).

of uric acid, cystin, and oxalate of calcium crystals. The same is true of the more fixed dull aching or more severe pain which can also be observed in a number of other renal affections.

What has just been said about pain is equally true of the other clinical pictures such as hæmaturia, pyuria, symptoms of acute infection, anuria, etc. The point which is to be emphasized is that in the absence of a history of the passage of calculi one must be prepared to be rudely awakened if reliance is placed upon the clinical history alone in the diagnosis of nephrolithiasis. A thorough urological study such as will be outlined in the next two subheadings must always supplement a good clinical history and general physical examination.

Is the shadow that of a renal calculus? Although theoretically there are a number of extrarenal conditions which can give rise to a shadow simulating that of a renal calculus, for practical purposes one need only consider those conditions due to calcified lymph nodes and to biliary calculi. As to the former, the irregular form, serrated edge and variation in density of the shadow (Fig. 7) are so characteristic that we have never found a differentiation very difficult. Shadows however may greatly resemble those of renal calculi at times, so that a diagnosis requires a familiarity with the shadows cast by biliary and renal calculi respectively and the employment of special diagnostic methods as adjuvants.

Gall-bladder calculi are usually of varying density (A, B, and C of Fig. 8), i.e., a less opaque center and dark periphery or vice versa. They are also seen in facetted form. In one of the cases seen in consultation, however, the opacity was uniform and in another it was not ovoid but long and also uniform (D of Fig. 8). In this case the shadow was that of a calculus in the common duct. If any question arises as to whether the shadow is due to a biliary or to a renal calculus it is advisable to make a cholecystogram and if there is still doubt, to see whether the shadow is in close relation to the opaque ureteral catheter and is

Fig. 7. Shadows of calcified lymph nodes. Note the irregular contour and unequal density of the shadows.

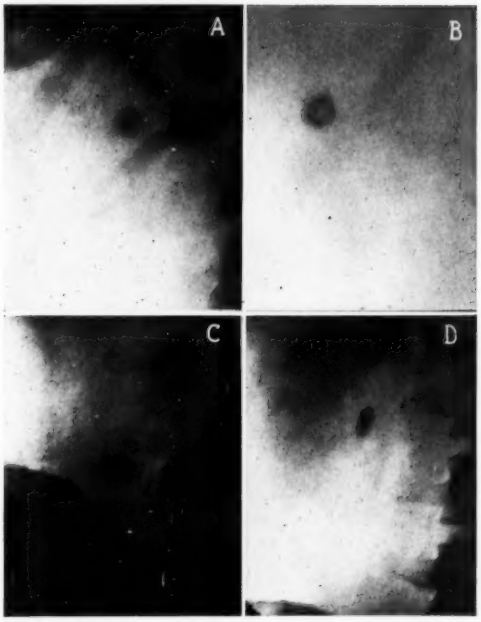


Fig. 8. Shadows of calculi in gall bladder and common duct. A. Dark center and light periphery. B. Light center and dark periphery. C. Unusual location due to hepatoptosis. D. Oblong shadow of uniform density due to calculus in common duct. (From Department of Roentgenology of the Michael Reese Hospital.)

also "included," i.e. covered by that of a pyelogram.

Renal calculus shadows are as a rule of uniform density but we have observed laminated ones with a light center and dark periphery.

The location of true (renal calculus) shadows varies according to (a) whether the kidney is in its normal position, (b) whether it is lower as the result of a congenital or acquired (abnormal mobility) ectopia, or (c) whether it is in one-half of a horseshoe kidney (Fig. 9). In the last named condition the shadows are on one or both sides, quite close to the spine and often at a much lower level (B of Fig. 9) than is the case with calculi in a normally placed kidney.

Thanks to rapid advances in radiographic technique, aided by the use of the opaque ureteral catheter and by the routine employment of pyelography we are able to demonstrate shadows of renal calculi in about 90 per cent of the cases before operation and furthermore to say with a fair degree of accuracy that a calculus lies at the ureteropelvic junction (Fig. 10) or in one of its calyces (Figs. 14 and 22). When a shadow suspected to be that of a renal calculus is "included" in that of the pyelogram the diagnosis of its intrarenal nature is far more certain than when an opaque catheter alone is employed.

What is the condition of the involved and of the opposite kidney? Before we proceed with the local examination, it should be a routine procedure in every well organized urological service to have an estimation of the total nonprotein nitrogen, or of the urea alone, and creatinin content of the blood made. Ureteral catheterization alone does not suffice to give us the requisite information regarding the damage which the involved kidney has sustained. The results of the blood chemistry tests and examination of the separate urines should always be supplemented by the use of one or both of the dye tests[1] in order to determine the functional capacity of the two kidneys. After this has been completed it has been the practice of the writer since the fall of 1925 to do a bilateral pyelography using a No. 5 catheter and 12.5 per cent solution of sodium iodide. Pyelography gives one a control of the renal function test because the uretero-

[1] We employ indigocarmin almost exclusively in the differential function test because the estimation with it is much simpler than with phthalein.

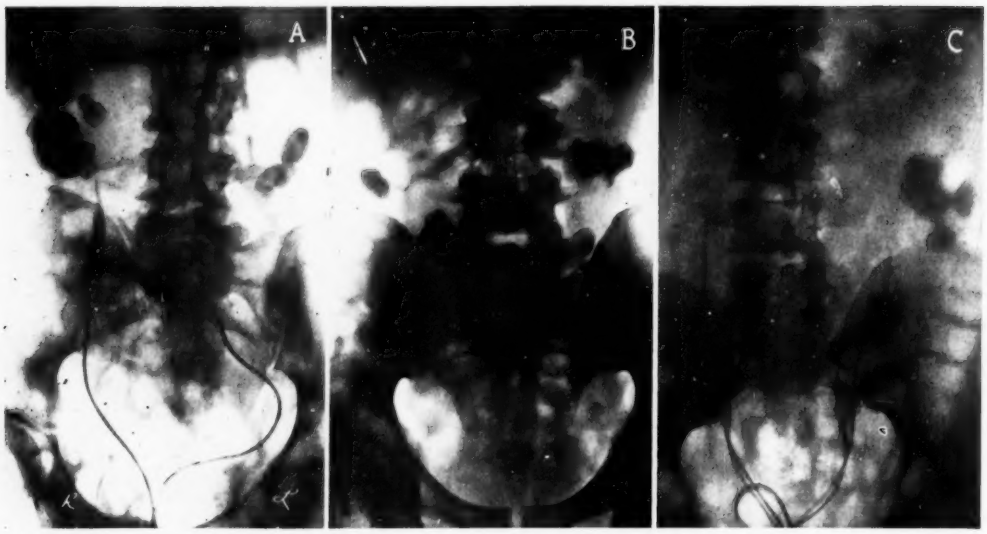


Fig. 9. Location of shadows of calculi in 2 cases of horseshoe kidney and 1 of double kidney, diagnosed before operation. A. Four shadows arranged obliquely with lowermost one close to spine. Case 2. B. Bilateral shadows at level of fourth lumbar vertebra. On the right side the shadows lie more laterally than on the left side where one is close to the spine. C. Shadow of coral calculus in lower half of a double kidney.

pyelogram of the involved side yields almost indispensable information as to (a) the degree of dilatation of the renal pelvis and its calyces (Figs. 3, 21 and 22), (b) the possible presence of a stricture of the ureter (Fig. 5), and (c) whether the calculous formation has taken place in a horseshoe, ectopic, hypoplastic or similar form of congenitally anomalous kidney.

It seems almost superfluous to add that operations for nephrolithiasis should not be undertaken until such a urological study has been made unless there is an emergency as in a calculous anuria. Even here ureteral catheterization of the blocked or of the opposite reflexly inhibited kidney will often enable one to tide the case over into a period when a more thorough examination can be made. Under all other conditions, we must possess before operation complete information as to the condition of the opposite kidney as well as of the one to be operated upon. In one of our cases we found an advanced contralateral hydronephrosis. In others we have discovered a marked degree of pyelonephritis in the opposite kidney which made the prognosis a very dubious one.

The association of tuberculosis of the kidney and calculus formation although comparatively rare, must always be thought of. We encountered two cases of this kind; in one there were multiple scattered shadows of varying density so that it was assumed before operation that stone formation had occurred secondarily in a tuberculous kidney. In the other patient, the shadow was irregular but of uniform density and the diagnosis of an associated renal tuberculosis was not made until the kidney was exposed (Fig. 11).

INDICATIONS FOR OPERATION

The indications for operation depend upon whether only one or both kidneys are involved. In the former instance we feel that a calculus so located as to constantly (Fig. 4) or intermittently (Fig. 22) block the outlet of the renal pelvis should be removed at as early a period as feasible. In cases with one fairly large calculus in the renal pelvis and multiple small ones in the major and minor calyces we have advised operation even when infection was present, hoping to be able to prevent a recurrence by frequent postoperative lavage

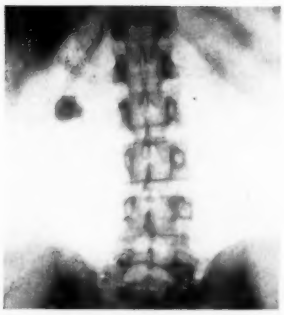


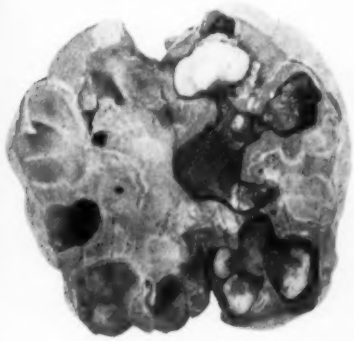
Fig. 10. Typical location and shape of shadows of calculus lying close to outlet of right renal pelvis.

Fig. 11. Kidney from case of renal tuberculosis associated with calculus formation. Note relatively large stone lying in renal pelvis and typical tuberculous cavities in parenchyma.

of the renal pelvis and treatment of any mechanical obstruction distal to the kidney. Our prognosis as to recurrence in such cases should however be very guarded.

In cases with multiple scattered calculi of varying size in which the pyelogram reveals marked dilatation of the calyces at the expense of the parenchyma (Fig. 3) we believe that nephrectomy is preferable and should be done unless the condition of the opposite kidney serves as a contra-indication. Under these conditions removal of the calculus which is blocking the pelvic outlet is justifiable. In the case of a small branching calculus more or less firmly wedged in a calyx (Fig. 12), we feel that if there is persistent pain or hæmaturia as was the case with several patients, operation is justifiable. In large branching (coral) calculi with but little parenchyma remaining (Fig. 13) only nephrectomy should be considered. We prefer usually to counsel against any operation unless an acute toxæmia complicates the case and even here one can usually secure equally good temporary results through the use of the inlying ureteral catheter.

Fig. 12. Small branching calculus lying in lower calyx of left kidney. Only symptom was painless hæmaturia. (See text.)



A B

Fig. 13. A. Typical shadow of large branching (coral) calculus completely filling pelvis proper and its calyces. B. Section of a kidney showing marked dilatation of renal pelvis and its calyces with almost complete pressure atrophy of the parenchyma.

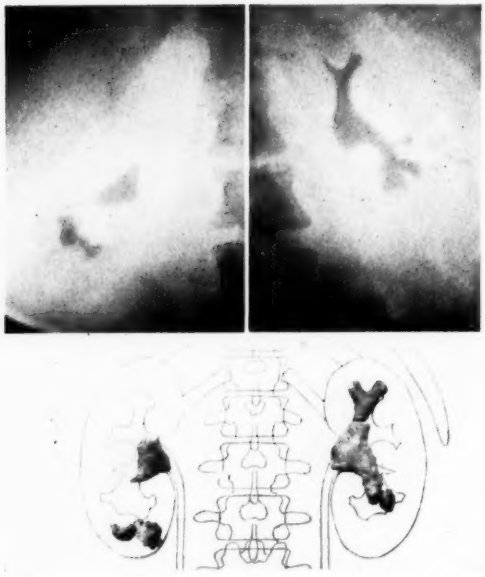


Fig. 14. Shadows in case of bilateral renal calculi. Symptoms were unilateral and due to blocking of right pelvic outlet by a triangular calculus. This was removed through a pyelotomy and two smaller ones through nephrotomy (minute) incisions. On opposite side, a branching calculus was removed through an enlarged pyelotomy and two small nephrotomy incisions.

As to bilateral calculi we have gradually become more and more conservative, especially if only the two kidneys and not the ureters are involved and there are numerous relatively

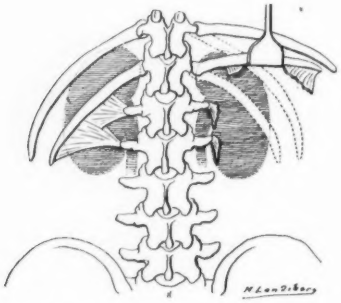


Fig. 16. Technique of division of costotransverse ligaments for purpose of mobilization of twelfth rib. On the left side, note the course of the ligaments from transverse processes of the first two lumbar vertebræ to the last rib. On the right side, observe how the rib can be retracted after division of these ligaments.

Fig. 15. Case of unilateral renal and bilateral ureteral calculi. The left sided one of the latter was first removed and two weeks later both the renal and ureteral on the opposite (right) side.

small renal shadows (B of Fig. 2) and not much evidence of active infection. The only indication for operation in the case of bilateral renal calculi for us at present is when one or both pelvic outlets are blocked by a calculus (Fig. 14) so that some improvement of function on one or both sides can be expected.

In cases of combined ureteral (unilateral or bilateral) and renal calculi on opposite sides it is imperative to remove the ureteral calculus (Fig. 15) first. If one removes the renal calculus first, the work of both kidneys is thrown upon the opposite one whose ureter is blocked and an anuria is a frequent result. In the case of renal and ureteral calculi on the same side we attempt to remove both at one sitting if possible and have done so in 3 cases successfully. If this is not advisable it is best to attempt to remove the ureteral calculi first by non-operative means and then operate on the kidney later. We did this in one case.

In cases of calculous anuria an effort should be made during the first 48 hours to relieve the condition by ureteral catheterization. One should never wait longer than this before performing a pyelostomy on the side to which the history or X-ray findings point as the obstructed one. We had three anuria cases in our series. In one there was congenital lack of development of the opposite kidney, in a

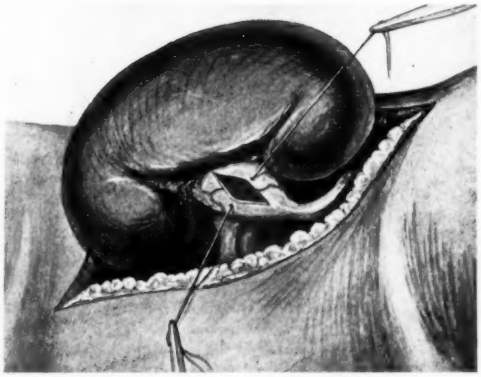


Fig. 17. Technique of posterior pyelotomy. After exposure of posterior (avascular) aspect of the renal pelvis, two traction catgut sutures are inserted and the pyelotomy incision made between these sutures.

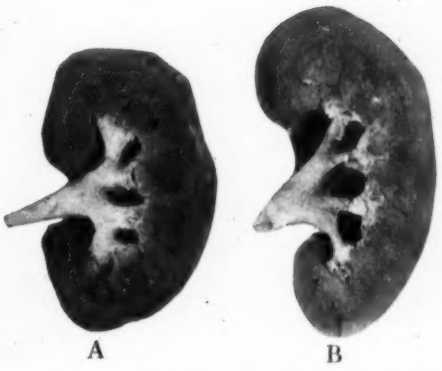


Fig. 18. Extrarenal and intrarenal pelves. A. The pelvis is almost entirely intrarenal and very difficult to open in case a pyelotomy is indicated. B. Greater portion of pelvis lies distal to renal hilus.

second, we removed an obstructing calculus from the right kidney in a case of bilateral renal calculi, and intended to operate for a similar condition on the opposite side 4 weeks later. On the sixth day after the right pyelotomy, anuria developed due to impaction in the lumbar ureter of the left renal calculus which had passed downward. In a patient whose opposite kidney had been removed elsewhere 5 years before for calculous pyonephrosis the pelvic ureter was blocked by a calculus.

With increased knowledge of the causes of recurrence we have become more and more conservative in advising operation in renal calculus cases unless the pelvic outlet or ureter is firmly blocked by a calculus.

TECHNIQUE AND POSTOPERATIVE COMPLICATIONS

We employ an incision which will give ample exposure so as to be prepared for unexpected hæmorrhage and firm adhesions. If the iliocostal space is narrow and the last rib long and impossible to retract easily, much space can be gained by following the suggestion of W. J. Mayo of division of the costotransverse ligaments (Fig. 16). Posterior pyelotomy (Fig. 17) is today the operation of choice. In

Fig. 19. Technique of palpation of interior of pelvis. Same method can be employed for pyelonephrotomy. The finger inserted through the pyelotomy incision steadies calculus lying in a calyx, while small nephrotomy incision is made over stone.

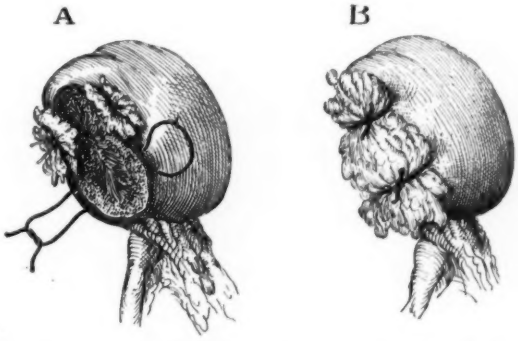


Fig. 20. Use of fat pads to reinforce sutures after small nephrotomies. (Hagenbach-Beer.) If a superficial gap still remains some fat can be sutured over the hiatus. (Koll.)

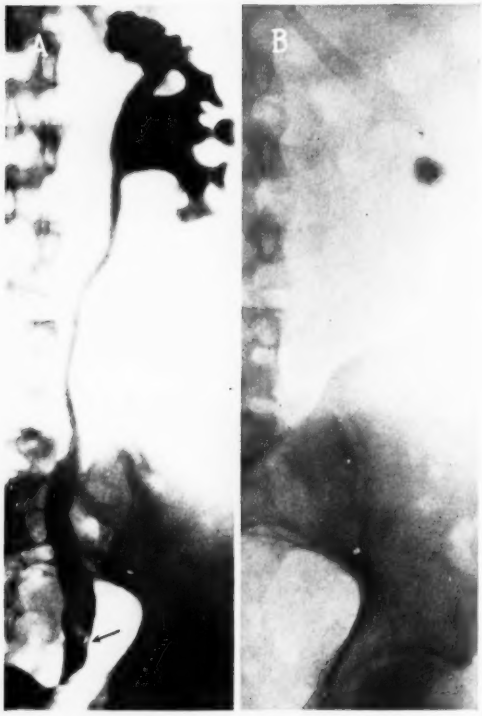


Fig. 21. Ureteropyelogram from case in which a calculus migrated from pelvic portion of left ureter (calculus location indicated by arrow) up to renal pelvis where it was found at operation. B. Shadow of calculus in lower calyx just before operation.

some cases this is very difficult because of fixation of the kidney by perirenal sclerosis and also because of peripelvic infection and thickening of the walls of the pelvis itself. One must always be on the lookout for polar (accessory) vessels and for anomalous retropelvic arteries and veins which can give rise to profuse and obstinate hæmorrhage. Some operators do not attempt to bring the kidney into the incision but we believe it much safer to do so if possible because of these anomalous vessels which may pass longitudinally across the back of the pelvis, an area usually avascular.

There are two types of renal pelves which are of interest from the standpoint of pyelotomy. In one the pelvis is about equally intrarenal and extrarenal (A of Fig. 18). In the other, the pelvis lies almost completely within the hilus, i.e. intrarenal (B of Fig. 18), a very unwelcome condition to encounter if the calculus is small. Although we seldom have occasion to extend the pyelotomy incision into the parenchyma, it is well enough to know that this can be safely done if one ligates the small retropelvic artery as described by us several years ago. As a rule we now explore the interior of the renal pelvis with the little finger inserted through the pyelotomy incision (Fig. 19). If a calculus is found which is too large to deliver easily through the pyelotomy opening, we prefer to make one or more small incisions (nephrotomy) through the cortex while the little finger inserted into the renal pelvis pushes the calculus toward the surface of the kidney. We have not found it necessary to employ the complete nephrotomy incision, i.e., one which more or less bisects the kidney. Such an operation is so frequently followed by postoperative bleeding, necessitating nephrectomy, that it is rarely employed either in this country or abroad at present. It is so easy to close the smaller nephrotomy incision by the use of fat pads to prevent the sutures from cutting through (Fig. 20) as suggested independently by Beer and Hagenbach, that we cannot see the necessity of larger incisions.

Several groups of cases which require special mention are (a) those in which both the renal pelvis and ureter are so greaty dilated (Fig. 21) that a calculus can migrate from the kidney to the lowermost portion of the ureter and vice versa. We take a plain X-ray just before operating in such cases and either apply a temporary ligature to the ureter just below the renal pelvis or have an assistant compress the ureter at this point and then open the pelvis. (b) A similar difficulty may be encountered when the pelvis alone is dilated and the stone which was at first seen in the extrarenal portion of the pelvis (A of Fig. 22) has moved back into a calyx (C of Fig. 22). Here the insertion of the little finger through the renal pelvis to fix the calculus and its delivery through a small nephrotomy incision proves the many advantages of such a combined pyelonephrotomy (Fig. 19). Before closing the pyelotomy incision we pass a large ureteral bougie in a retrograde manner.

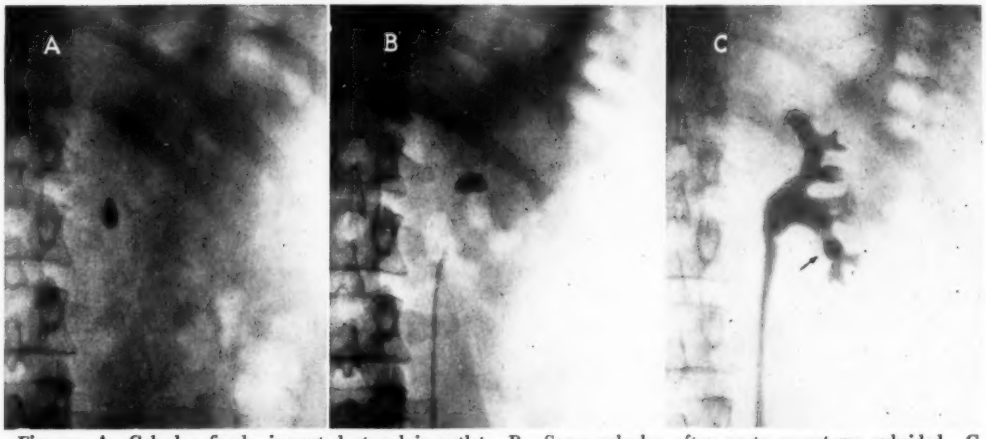


Fig. 22. A. Calculus firmly impacted at pelvic outlet. B. Same calculus after acute symptoms subsided. C. Pyelogram showing calculus in lower calyx where it was found at operation.

Let me urge those who have occasion to perform nephrectomy to familiarize themselves with the great advantages of two methods of securing the pedicle, viz. (a) the two clamp method[1] as first suggested by W. J. Mayo and (b) the subcapsular method of Federoff.[2] In both, the clamps are applied and the pedicle divided before ligation. Thus the vessels may be ligated with far greater ease than when the kidney remains *in situ*. The Federoff method is of especial value when there are such advanced fibrous changes in the perinephritic tissues that access to the pedicle is impossible. We have never been obliged to leave clamps on the pedicle since becoming familiar with these two methods.

The most important postoperative complications are the following:

a. *Reflex paresis of the intestines.* This appears about the second day and the obstipation, inability to pass flatus, and abdominal distention lead one to think of a true ileus. The paresis is rarely fatal, yielding quite rapidly to doses of pituitrin and repeated milk and molasses enemas. One must overlook the possible existence of a mechanical ileus due to some intraperitoneal cause.

b. *Acute gastric dilatation.* This is often the result of too large a quantity of liquids being given immediately after operation before the parçsis of the gastric musculature has disappeared. Whenever the patient appears as if in collapse, with marked dyspnœa, cyanotic lips, rapid pulse, etc., or if he vomits large quantities of brownish fluid, a gastric lavage should be done at once.

c. *Oliguria, uræmia, and anuria.* This ought not to occur if our study of the opposite kidney has been a thorough one. Those who have the immediate postoperative care of kidney cases should always keep close track of the intake and output of fluids. The opposite kidney is often the seat of a temporary postoperative hyperæmia which may interfere with its function. As a prophylactic measure, especially after nephrectomy, we have for a number of years followed a suggestion of Dr. G. Kolischer and given continuous proctoclysis of tap water containing 15 grains of diuretin to the quart for the first 48 hours in order to stimulate the opposite kidney. For the singultus which is often a sign of postoperative renal insufficiency we have found the intravenous administration of 250 to 500 cubic centimeters of a 10 per cent solution of glucose to be superior to any other method of treatment.

In regard to later postoperative treatment we can only again emphasize the value of frequent lavage of the renal pelves, dilatation of ureteral strictures, and the elimination of mechanical obstruction in the bladder or urethra.

[1] See Mayo Clinics, 1912.
[2] Surg., Gynec. & Obst., 1917, xxiv, 1.

EXPERIMENTAL STUDIES IN PULMONARY SUPPURATION[1]

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THE PRODUCTION OF THE TUBERCULOUS ABSCESS

THE pioneer contributions of Friedrich (7), Brauer (4), and Sauerbruch (15), in the surgical treatment of pulmonary tuberculosis have provided an increasingly promising line of attack against this dreaded disease. It is an arresting fact that as the operative treatment of so-called "surgical" tuberculosis elsewhere in the body is being supplanted by the purely medical treatment of rest and sunlight, the application of surgery to pulmonary tuberculosis is assuming increasing importance. As this phase is a comparatively recent development in surgical therapy, the following contribution is presented in the hope that it may furnish an incentive and a method for a more exact experimental study of the many problems suggested by this interesting phase of thoracic surgery.

Working in the surgical laboratory of the Western Reserve University, Holman, with the collaboration of Weidlein and Schlueter (10, 11), recently developed a simple procedure for the production of pyogenic pulmonary abscesses. The method was suggested by the studies of Fetterolf and Fox (6) who contributed the first experimental evidence that septic emboli from the operative field might be responsible for the development of the post-tonsillectomic pulmonary abscess. A practical application of their theoretical considerations was made by introducing bits of infected tonsillar tissue into the jugular vein. These were arrested in the pulmonary circulation and were there responsible for the first experimentally produced pulmonary abscesses.

The problem of pulmonary suppuration had for many years successfully withstood experimental attack. In 1919, under the direction of Dr. George Heuer, Holman attempted to produce pulmonary abscesses by placing infected bullets directly into the pulmonary tissue by thoracotomy. Only one small abscess was produced in numerous attempts. Aschner (2) in 1922 referred to numerous unsuccessful attempts to produce pulmonary suppuration by introducing infected material directly into the bronchial tree. Lambert and Miller (12) attempted to produce pulmonary lesions in monkeys by the intratracheal injection of anaerobic organisms, in conjunction with tonsillectomy, but no lesions occurred. Following the successful use of tonsillar tissue as emboli, bits of infected muscle and cylinders of potato containing various organisms were introduced into the jugular vein and, again, pulmonary abscesses were produced. The simple injection of bacteria into the blood stream will not produce pulmonary suppuration, and the use of protein and vegetable matter as a vehicle for conveying infection to the lung was suggested by an old observation of Dr. Halsted (8). He found that the injection of an emulsion of bacteria into the abdominal cavity failed to produce peritonitis, but when these same bacteria were placed upon a bit of organic material and this introduced into the peritoneal cavity, peritonitis invariably followed. To provide a more uniform type of embolus in relation to the size of the animal and also to provide a more convenient method of introducing any desired infective agent, the method was finally standardized, at the suggestion of Holman, by employing small segments of the femoral vein, tied at both ends and containing a mixture of pyogenic bacteria.

The method was applied in a study of tuberculous infection of the lung and some interesting observations were made, as illustrated by the following protocols.

Method. All experiments were performed on dogs, under complete ether anæsthesia. The jugular vein was isolated and a short segment about 12 to 16 millimeters long was removed. One end of this segment was ligated with silk. Into this segment of vein live human tubercle bacilli grown on an egg medium were introduced. A lead shot, previously

[1] Presented before the Idaho State Medical Association, September 3, 1926.

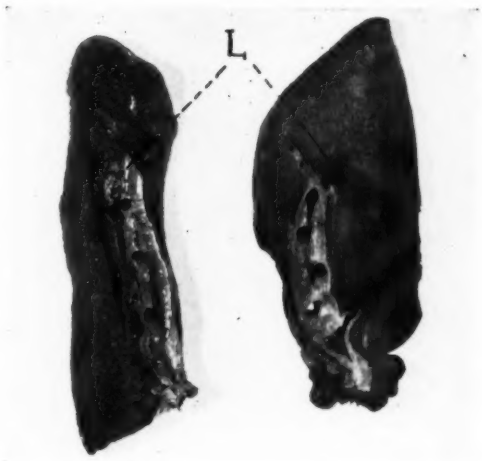
immersed in paraffin to render it inert, was also introduced into the segment to permit localization of the embolus by the roentgen ray. The second end was then tied with silk and the embolus sent on its mission by introducing it into the proximal portion of the divided jugular vein. In order to study chronologically and pathologically the development of the tuberculous abscess, the lobes containing the embolus were excised at varying intervals following the introduction of the embolus.

H21: 6-hour specimen. Six hours after the introduction of a tuberculous embolus, the right upper lobe was excised. The specimen, expanded with air, showed roentgenographically no evidence of consolidation or infarction due to the embolus. Externally, and on palpation, no pulmonary changes were demonstrable. The cut section (Fig. 1) showed the embolus lying in the artery only a millimeter removed from the bronchus with no changes in the pulmonary tissue beyond it.

H22: 24-hour specimen. Twenty-four hours after the introduction of a tuberculous embolus, the right lower lobe was removed. Just previous to the lobectomy the following observations were made: temperature 103.2, respirations 48, and pulse 152. The freshly removed specimen showed an irregular quadrilateral area of pallor over the surface of the lobe in its peripheral half. There was no increased firmness of the pulmonary tissue except in the immediate proximity of the embolus. The cut section (Fig. 1) showed the shot lying in a small cavity, surrounded by a narrow zone of firm, congested pulmonary tissue. There was no evidence of alteration in the tissue beyond the embolus except the marked pallor on a limited part of the surface of the lung.

2H14: 5-day specimen. Five days after the introduction of a tuberculous embolus the lower right lung was removed. The surface of the excised lobe appeared everywhere normal except a small raised blister 1 millimeter in diameter on its posterolateral surface, which broke with the discharge of a small bead of pus. The cut surface of the lobe revealed the embolus lying 2½ centimeters from the hilus, 1 millimeter removed from the bronchus (Fig. 2). Beyond the embolus in the distal half of the lobe was a quadrilateral area slightly darker in color and firmer to palpation than the normal lung. It suggested early hæmorrhagic infarction. On the surface at one edge of this altered pulmonary tissue lay the minute cavity described above.

H19: 7-day specimen. The right lower lobe was excised 7 days following the introduction of a tuberculous embolus in the jugular vein. In the distal half of the excised lobe could be felt a quadrilateral area which was firm, non-air containing, slightly œdematous, which showed on the surface as a dark discolored segment. The cut surface showed the embolism lodged half way between the hilus and the tip of the lobe, within 1 millimeter of the main bronchus (Fig. 2). Beyond the embolus was a quadrangular area of dark, firm, pulmonary tissue, which extended to the periphery in wedge shaped fashion—a true hæmorrhagic infarction. Just beyond the embolus was a small, softened area which appeared to be due to an early necrosis of pulmonary tissue.



H21 H22

Fig. 1. H21: 6-hour specimen following introduction of tuberculous embolus in jugular vein. H22: 24-hour specimen showing narrow zone of consolidation around tuberculous embolus.

L = Location of embolus in close proximity to main bronchus to lobe.

H16: 13-day specimen. The left lower lobe was recovered 13 days following the introduction of a tuberculous embolus into the jugular vein. The undistended specimen revealed a quadrilateral area of firm, non-air containing pulmonary tissue in the peripheral half of the lobe, which showed on the surface as a quadrangular area of dark discoloration. The cut surface (Fig. 2) disclosed the shot lying in a small cavity about half way between the hilus and the tip of the lung. Beyond the shot was a quadrangular area of mottled grayish white pulmonary tissue, this area extending to the periphery of the lobe. It was apparent that the hæmorrhagic infarction noted in H19 had given place in this animal to tuberculous caseation with the formation of a small abscess cavity.

2H15: 16-day specimen. On July 9, 1926, this animal received for the second time a tuberculous embolus in the jugular vein; 16 days later the upper left lobe was excised. In the medial peripheral half of the lobe was a quadrilateral segment of firm lung, the surface of which was somewhat retracted; its color on the surface was bluish black in comparison to the pink of the adjacent normal lung. The cut

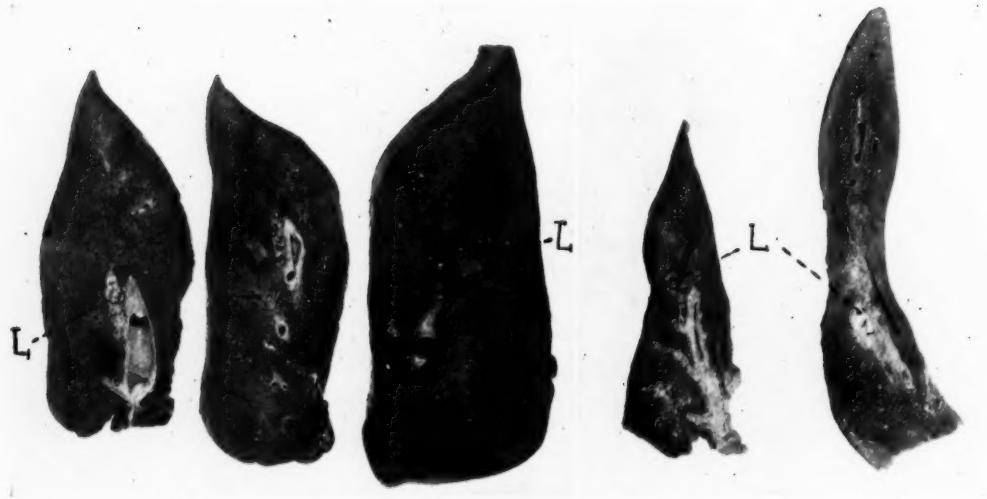


Fig. 2 (to be compared with Fig. 3). 2H14: 5-day specimen following introduction of tuberculous embolus, showing early discoloration of hæmorrhagic infarction. H19: 7-day specimen showing well advanced wedge-shaped consolidation due to hæmorrhagic infarction. H16: 13-day specimen showing beginning tuberculous consolidation. 2H15: 16-day specimen showing more advanced caseous consolidation.
L = Location of embolus.

surface showed the embolus lying about 2 centimeters from the hilus, only 1 millimeter removed from the bronchus. Beyond the embolus was a quadrangular area of mottled caseous consolidation with no areas of softening or abscess formation (Figs. 2 and 3).

H14: 23-day specimen. On March 24, 1926, this animal received a tuberculous embolus. On the next day the following observations were made: temperature 103.2 degrees F., respirations 22, pulse 176; leucocytes 16,220, of which 87 per cent were polymorphonuclears, 10 per cent lymphocytes, 2 per cent basophiles and 1 per cent transitionals. On April 5, 12 days after the introduction of the embolus, a small abscess cavity was distinguishable in the roentgenogram. On April 8 the temperature was 101.6, respirations 30, pulse 108, leucocytes 8,900, of which 77 per cent were polymorphonuclears, 22 per cent lymphocytes and 1 per cent eosinophiles. On April 16 the left lower lobe was excised. The specimen

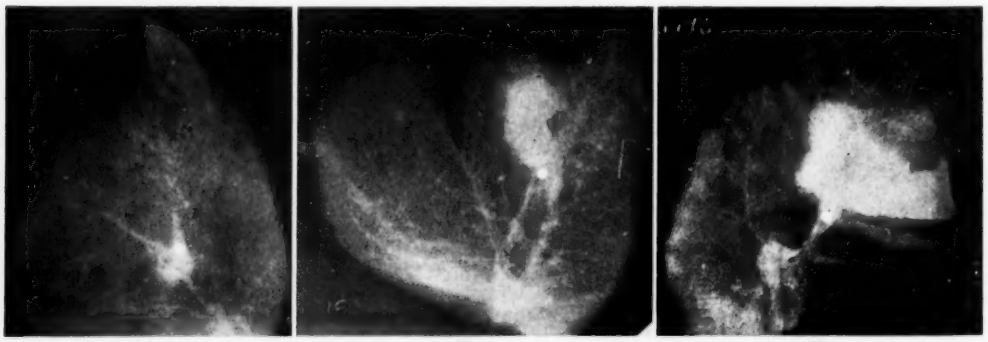


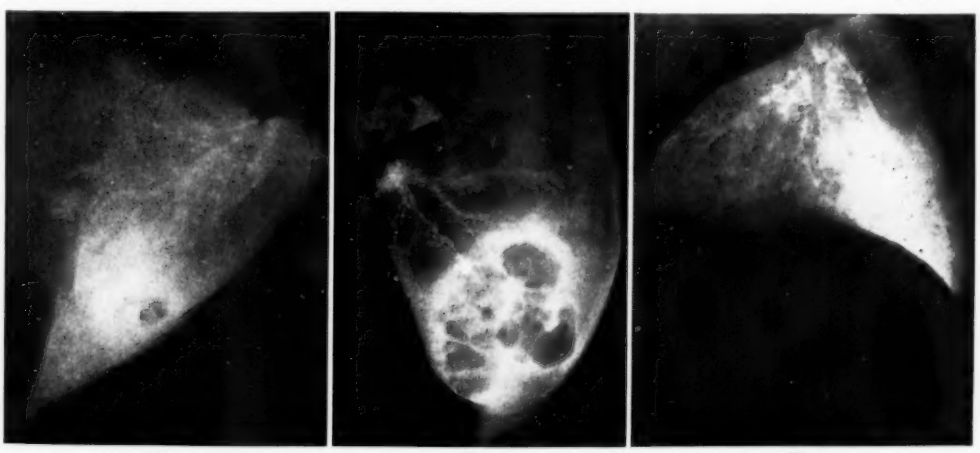
Fig. 3. Roentgenograms of excised specimens pictured in Figure 2. 2H14: Narrow zone of consolidation about embolus with only slightly increased density of pulmonary tissue beyond embolus. H19 and 2H15: Marked increased density in quadrilateral area of infarction beyond embolus.

H14 H11 H15

Fig. 4. H14: 23 day specimen showing abscess formation in quadrilateral area of caseation beyond tuberculous embolus. H11: 25 day specimen showing multilocular abscess due to tuberculous embolus. H15: 35 day specimen showing widespread caseation and abscess formation in infarcted area.

showed in the peripheral half of the lobe, a firm non-air containing portion with areas of softening which appeared on the surface as thin walled blebs. The cut surface showed the embolus lodged in about the center of the lobe, beyond which lay a quadrilateral area of caseous consolidation containing a multilocular abscess (Figs. 4 and 5).

H11: 25-day specimen. On March 18, 1926, this animal received a tuberculous embolus in the jugular vein. Two days later the following observations were made: temperature 102, respirations 22, pulse 108, the leucocytes numbered 20,200, of which 67 per cent were polymorphonuclears, 28 per cent lymphocytes, mononuclears 3 per cent, eosinophiles 2 per cent. On April 6 the animal showed a temperature of 101, respirations 20, pulse 66, leucocytes 10,200, of which 58 per cent were polymorphonuclears, 40 per cent lymphocytes, and 2 per cent mononuclears. The animal became very weak and emaciated, and was killed on April 12, the twenty-fifth day following the introduction of the embolus. No pathological changes except those in the right lower lobe were discovered. This lobe showed on the surface several large thin walled blebs which projected



H14 H11 H15

Fig. 5. Roentgenograms of excised specimens pictured in Figure 4, showing consolidation and cavitation in pulmonary field beyond embolus.

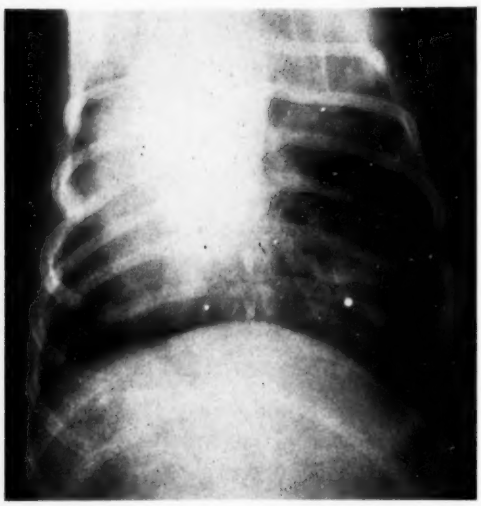


Fig. 6. Roentgenogram of 3H15 eighteen days after introduction of tuberculous embolus, showing (1) mottled consolidation and abscess formation beyond embolus; (2) residual pneumothorax on left side 26 days after lobectomy; (3) displacement of heart to left, elevation of diaphragm and partial collapse of chest wall after complete removal of left lung.

beyond the surrounding pulmonary tissue. They marked the location of a large intrapulmonary multilocular abscess surrounded by a narrow margin of white, solid, caseating pulmonary tissue (Fig. 4).

H15: 35-day specimen. On April 21, 1926, a tuberculous embolus was introduced into the jugular vein. On the next day the following observations were made: temperature 101.4, respirations 24, pulse 168, leucocytes 15,900, of which 80 per cent were polymorphonuclears, 19 per cent lymphocytes and 1 per cent large mononuclears. On April 24 the animal's temperature was 103.8, respirations 42, pulse 156. By April 26 the respirations had dropped to 24, pulse to 96 and temperature to 102.6. A roentgenogram on April 28 showed a considerable area of density about the shot and by May 3, 12 days after the introduction of the embolus, a small abscess, 6 millimeters in diameter, had appeared in the center of a zone of consolidation about 2 centimeters in diameter. The temperature on this date was 102.2 respirations 18, pulse 108. On May 6 the leucocytes numbered 12,600, of which 63 per cent were polymorphonuclears, 36 per cent lymphocytes and 1 per cent eosinophiles. On May 13 the leucocytes numbered 9,500, of which 58 per cent were polymorphonuclears, and 42 per cent lymphocytes. On May 26, 35 days after the introduction of the embolus, the left lower lobe was excised. Presenting on the surface were several small, thin walled blebs projecting beyond the surrounding pulmonary tissue. The lobe showed a firm consolidation of an area fully 4 centimeters in diameter. The cut surface disclosed the embolus lying in about the center of the lobe, only a millimeter removed from the bronchus. Beyond the embolus was an irregular circular area of caseous consolidation with an abscess cavity in its center (Figs. 4 and 5). On July 6 the leucocytes numbered 14,800. of which 73 per cent were polymorphonuclears, and only 23 per cent lymphocytes. The marked relative lymphocytosis previously noted had again subsided following the removal of the tuberculous abscess.

H12: 41-day specimen. On March 18, 1926, this animal received a tuberculous embolus. The first roentgenographic evidence of an abscess appeared on April 13, when the lower right lobe showed a cavity approximately 8 by 12 millimeters in diameter. On April 28 this lobe was excised. The specimen showed an area of consolidation and mottled discoloration which contained also a ragged, irregular abscess, about 14 by 10 by 6 millimeters. The pulmonary tissue surrounding the abscess was firm and contained ragged areas of necrotic material. The cut surface showed the shot in about the center of the lobe, with evident caseous consolidation proximal as well as distal to it.

H13: 51-day specimen. On March 24, 1926, the leucocytes numbered 10,040, of which 69 per cent were polymorphonuclears, 30 per cent lymphocytes and 1 per cent transitionals. On this same day the animal received a tuberculous embolus in the jugular vein. Twenty-four hours later the following observations were made: temperature 98, respirations 20, pulse 92, leucocytes 18,460, of which 64 per cent were polymorphonuclears, 35 per cent lymphocytes and 1 per cent basophiles. On April 5 a roentgenogram revealed little change around the shot. The temperature was 101.4, respirations 24, pulse 108. On April 21 a roentgenogram showed an area of consolidation 2 centimeters in diameter, in the center of which was a cavity about 1 centimeter in diameter. On May 6 the animal was active, eating well and seemed practically normal although the roentgenogram showed a well defined abscess about 2 centimeters in diameter. On May 8 a change occurred, the animal became progressively less active, refused food, and developed a foul odor to his breath. On May 14 the following observations were made: temperature 102, respirations 32, pulse 120, leucocytes 10,200, of which 48 per cent were polymorphonuclears, 52 per cent lymphocytes. The lobe containing the abscess was excised. The specimen showed several blebs on the surface, marking the location of a deeply seated, firm indurated area about 2.5 centimeters in diameter. The cut surface showed a large abscess cavity surrounded by a thick fibrous wall, beyond which the pulmonary tissue appeared normal.

3H15. This animal had received on two previous occasions tuberculous emboli for which lobectomy had twice been performed for the recovery of the specimens, with the result that the entire left lung had been resected. A third tuberculous embolus was

H5 2H18 H2

Fig. 7. H5: Specimen obtained 5 days after introduction of pyogenic embolus with abscess formation in area of infarction. 2H18: Specimen obtained 9 days following introduction of pyogenic abscess. Note quadrilateral area of infarction extending to periphery with abscess in close contiguity with main bronchus. H2: Specimen obtained 13 days after introduction of pyogenic embolus.

introduced into the femoral vein on August 3. On August 21 a roentgenogram revealed an extensive consolidation of pulmonary tissue in the left lower lobe with a large central abscess (Fig. 6). The roentgenogram also revealed a residual pneumothorax still evident 26 days after a previous lobectomy, but there was no fluid present. The heart was displaced to the right, the diaphragm was elevated, and the chest wall was partially collapsed, thus illustrating the three factors that contribute to the obliteration of the dead space which follows pneumectomy. The animal is still living and active. In the presence of the tuberculous abscess, the temperature on August 21 was 102.6, pulse 186, and respirations 30.

Certain observations from the preceding protocols may be emphasized:

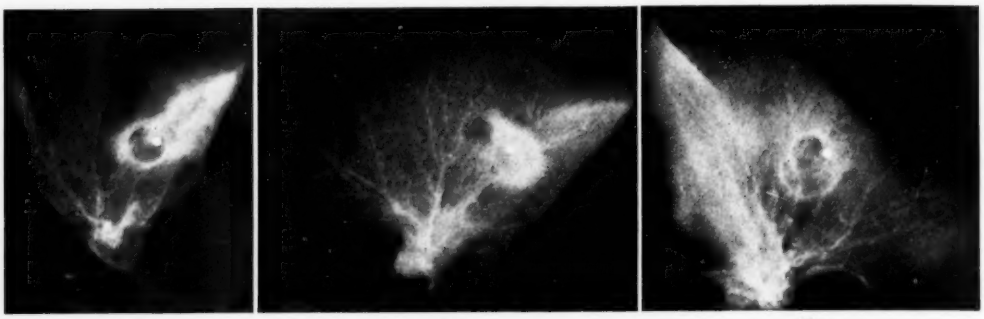
Marked pathological changes were invariably produced in the lung following the introduction of a tuberculous embolus in the jugular vein, the extent of these changes depending upon the interval of time which had elapsed since the embolus was introduced. The first change to occur was an evident pallor over a restricted portion of the surface of the affected lobe, caused by an anæmia of the tissues beyond the embolus. This anæmia gradually gave place to a true hæmorrhagic infarction, and this in turn was replaced by caseation, central softening, and abscess formation within the infarcted area.

The first evidence of an abscess following the introduction of tuberculous emboli appeared on the twelfth day. In Corper's (5) work on the experimental production of tuberculosis by aspiration, visible cavities were found only after 139 days.

The effect of a tuberculous abscess on the formed blood elements was clearly shown by our observations. Immediately following the introduction of the tuberculous embolus, there occurred an initial rise in the number of leucocytes. This number quickly returned to a normal figure. In this normal number, however, there was a relative preponderance of lymphocytes (H13, H11), an observation in marked contrast to the well sustained polymorpholeucocytosis encountered after the introduction of a pyogenic embolus. This relative lymphocytosis subsided following removal of the affected lobe (H15).

OBSERVATIONS FOLLOWING THE INTRODUCTION OF PYOGENIC EMBOLI IN THE JUGULAR VEIN

Whereas the tuberculous embolus initiates what appears to be a fairly constant sequence of events in the lung, the introduction of a pyogenic embolus has been found to be most uncertain in its effects, the same embolus in



H5 2H18 H2

Fig. 8. Roentgenograms of excised specimens pictured in Figure 7.

different animals producing widely different results, varying from a rapidly fatal hæmorrhagic consolidation of a lobe to only minor and transient changes. To illustrate these variable results, and to serve as a contrast with the changes initiated by the tuberculous emboli, the following protocols are presented:

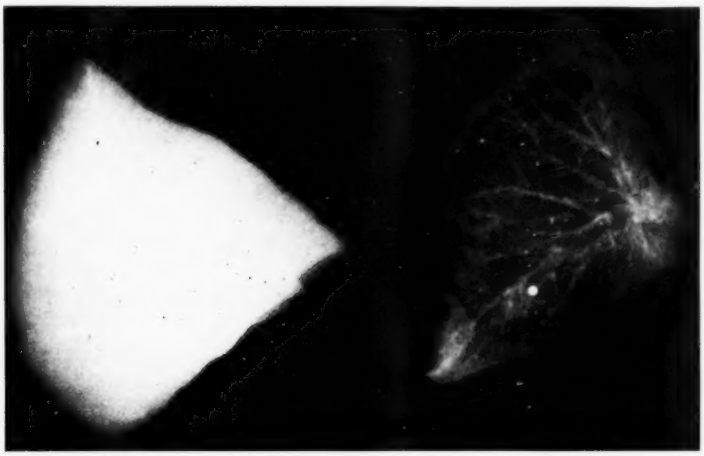
H1. On December 18, 1925, this animal received into the jugular vein an embolus containing staphylococcus aureus, streptococcus hæmolyticus, and bacillus coli. During the first few days following the introduction of the embolus, the temperature was elevated to 105 degrees F. This gradually subsided and within 9 days the animal seemed to have recovered completely. Roentgenographic studies on December 22 showed an area of increased density surrounding the shot which lay in the right lower lobe. By January 18, only a slight increased density persisted. The lobe, removed on January 22, showed moderate fibrous thickening around the shot which lay in a very small cavity (Fig. 9).

H2. This animal received on December 18 an embolus identical with that introduced into H1, and died 13 days later with a foul nasal and oral discharge, and a well defined abscess cavity present in the left lower lobe (Figs. 7 and 8). Roentgenographic evidence of a small abscess appeared on the fourth day after the introduction of the embolus.

H17. On May 4 the leucocytes numbered 8,900, of which 60 per cent were polymorphonuclears, 31 per cent lymphocytes, and 8 per cent eosinophiles. On May 5 this animal received an embolus containing non-hæmolytic streptococcus and bacillus coli. On May 8 the following observations were made:

2H21 H10 H7 H1 H18

Fig. 9. 2H21, H10, H7: Complete consolidation of lobes obtained 4, 4, and 2 days respectively following the introduction of pyogenic emboli which caused the death of the animals. H1: specimen obtained 35 days after introduction of pyogenic embolus, when the animal had completely recovered. Note fibrosis around embolus lodged in minute abscess cavity. H18: Specimen obtained 63 days after introduction of pyogenic embolus, showing no evidence of pathological changes except presence of shot.



2H21 H18

Fig. 10. Roentgenograms of specimens pictured in Figure 9, showing complete consolidation in 2H21 and absence of all pathological changes in H18.

temperature 103, respirations 36, pulse 150, leucocytes 21,200, polymorphonuclears 83 per cent, lymphocytes 9 per cent, eosinophiles 5 per cent; blood culture negative. On May 12 the blood culture was positive for bacillus coli and streptococcus non-hæmolyticus, but negative again on May 18. On May 20 the leucocytes numbered 18,200, of which 71 per cent were polymorphonuclears, 25 per cent lymphocytes, and 4 per cent eosinophiles. Roentgenographically, the left lower lobe showed an area of increased density as early as May 8, but no definite evidence of abscess formation at any time. The animal recovered entirely from the effects of the embolus and on May 21 the lung containing the embolus was excised. The lobe showed a mottled area of infarction beyond the embolus which was well on the road to resolution.

H18. On May 4, 1926, this animal's leucocytes numbered 13,800, of which 50 per cent were polymorphonuclears, 34 per cent lymphocytes, 16 per cent eosinophiles. On May 5 the animal received an embolus identical with that employed in H17. On the next day the temperature was 101, pulse 144, respirations 24. A blood culture proved negative. On May 8 the temperature was 101, respirations 24, pulse 132. The leucocytes numbered 18,300, of which 77 per cent were polymorphonuclears, 19 per cent lymphocytes, and 4 per cent eosinophiles. A blood culture was positive for bacillus coli, and streptococcus non-hæmolyticus. A blood culture on May 12 was again positive for the same organisms, but negative on May 19. Roentgenograms showed on May 8 a slight hazy density about the shot which had completely disappeared by May 19. On July 7, the animal appearing normal in every respect, the right lower lobe was removed. The freshly excised specimen showed small areas of depressed scarring on the posterolateral surface of the lung, with a well marked quadrilateral area of pallor on the surface. On palpation there was no congestion around the shot and the cut surface showed only normal pulmonary tissue. The shot, surrounded by a thin fibrous wall, lay a millimeter removed from the bronchus (Figs. 9 and 10).

2H18. On July 12 the animal received a second embolus of staphylococcus aureus, streptococcus hæmolyticus, and bacillus coli. On July 16 the following observations were made: temperature 102.4, respirations 24, pulse 112, blood culture positive for all three organisms originally introduced. The roentgenogram showed an area of consolidation around the embolus 2 centimeters in diameter. On July 20 the roentgenogram revealed an abscess cavity about a centimeter in diameter. In the presence of this abscess, the leucocytes numbered 18,850, of which 80 per cent were polymorphonuclears, 16 per cent lymphocytes, 2 per cent transitionals, and 2 per cent eosinophiles. On July 21 the lobe containing the abscess was removed. A blood culture taken at operation revealed a growth of staphylococcus aureus. The animal died the following day with complete consolidation of the only remaining pulmonary tissue. The excised specimen showed a quadrilateral segment of infarcted pulmonary tissue with an abscess cavity containing the embolus (Figs. 7 and 8). The embolus lay only a millimeter removed from the bronchus, with which, however, the cavity did not communicate.

H5. On January 20, 1926, this animal received an embolus containing non-hæmolytic streptococcus, staphylococcus aureus, and bacillus coli. Five days later the following observations were made: temperature 106, pulse 220, respirations 22. The animal died on the sixth day. The left lower lobe contained

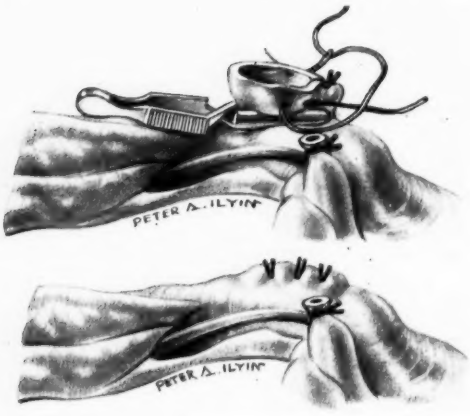


Fig. 11. Method of atraumatic inversion of bronchus: (a) bronchus temporarily closed by non-crushing clamp; (b) inversion obtained by two and three rows of interrupted fine silk sutures applied in peribronchial tissues.

Fig. 12. Specimens of bronchial stumps after atraumatic inversion: (a) 24-hour specimen, (b) 34-day specimen, (c) 15-day specimen, (d) 24-hour specimen.

a firm area about 3 by 4 centimeters which extended to the periphery where the lung was darkly discolored over a small segment. On section, an abscess cavity about 1 centimeter in diameter was present, the cavity containing the lead shot. Beyond the cavity the lung was firm and gray mottled in a wedge-shaped area extending to the periphery (Figs. 7 and 8). The death of this animal could not be attributed to the pulmonary abscess alone, and our other studies indicate that death was probably due to a septicæmia.

H7. On January 29, 1926, the animal received into the jugular vein an embolus containing non-hæmolytic streptococcus, staphylococcus aureus, and bacillus coli. On the next day the following observations were made: temperature 105, pulse 176, and respirations 26. Death followed in 24 hours. The right lower lobe showed complete hæmorrhagic consolidation (Fig. 9) with no air containing areas, the bronchi being filled with a tan exudate. There was complete closure by retrograde thrombosis of that part of the artery which lay proximal to the embolus up to the point where the main artery to this lobe divided.

H8. On January 29, 1926, an embolus identical with that used in H7 was introduced into the jugular vein. On the following day the temperature was 102, pulse 164, respirations 24. This animal at no time seemed ill and the pulse and temperature gradually subsided. It was killed on April 1, when the left upper lobe, which had harbored the embolus, was found to show slight scarring on the surface due to a healed infarct, but there was no other reaction referable to the embolus. This animal had completely withstood an embolus which had proved rapidly fatal in H7.

H10. On February 10 an embolus containing staphylococcus aureus, streptococcus non-hæmolyticus, and bacillus coli was introduced into the jugular vein. On the next day, February 11, the following observations were made: temperature 103, pulse 140, respirations 18; white blood cells 32,500; polymorphonuclears 85 per cent, lymphocytes 12 per cent, transitionals 3 per cent. A blood culture was positive for streptococcus non-hæmolyticus and for bacillus coli. On February 13 additional observations revealed a temperature of 105.4, pulse 204, respirations 48; white cells 28,700; polymorphonuclears 87 per cent, lymphocytes 9 per cent, transitionals 2 per cent, eosinophiles 2 per cent. The animal died on the fourth day after the introduction of the embolus. At necropsy, the left pleural cavity contained 20 cubic centimeters of turbid fluid, and the left lower lobe showed a massive hæmorrhagic consolidation with almost no air containing areas (Fig. 9). The embolus lay in one of the main branches of the pulmonary artery 6 centimeters removed from the hilus, but within 1 millimeter of the main bronchus to the lobe. The liver and spleen showed, macroscopically, numerous small white spots which proved to be areas of necrosis with leucocytic infiltration—secondary to the blood stream infection.

H9. This animal received on February 10 an embolus identical with that introduced into dog H10. In spite of a positive blood culture for staphylococcus aureus on February 11, and for staphylococcus aureus and bacillus coli on February 13, 16 and 20, this animal proceeded to a complete recovery, and when killed on April 1 the left lower lobe showed a slightly retracted pale area on its surface—the remains presumably of an old infarction. The underlying lung, however, was air containing, and normal in appearance. The shot which formed part of the embolus lay within a small abscess cavity measuring 7 by 4 by 3 millimeters. Again an embolus which proved fatal in H10 was almost without permanent effect in another animal

2H21. This animal received on July 9, 1926, a jugular embolus containing bacillus coli, streptococcus hæmolyticus, and staphylococcus aureus, from which the animal died 4 days later. A blood culture positive for all three of the original organisms was obtained within 24 hours of their introduction. On the day preceding death, the temperature was 103, respirations 40, and pulse 180. At necropsy, the left chest contained 3 ounces of purulent fluid, and the left lower lobe was completely consolidated

(Figs. 9 and 10), with an area of softening and early necrosis of pulmonary tissue in its center.

H23. On July 12 this animal received a pyogenic embolus containing streptococcus non-hæmolyticus and bacillus coli. Before the operation the pulse rate was 100; at the end of the operation it was 92; 6 hours later the pulse rate was 72, and respirations 24. On the following day the temperature was 101.6, respirations 26, and pulse 120. On July 16 the following observations were made: temperature 104.6, respirations 26, pulse 132. A blood culture was positive for bacillus coli and non-hæmolytic streptococcus. The animal completely recovered and on August 2, 1926, 21 days after the introduction of the embolus, the whole right lung was removed. The surface of the affected lobe showed no evidence of any pathological change, and the shot could be felt in the center of the lobe without the slightest reaction about it. The cut surface revealed only normal pulmonary tissue.

From the preceding protocols it is apparent that the effect of introducing a pyogenic embolus into the venous circulation differs very widely in different animals. There may occur only a local consolidation and pneumonitis about the embolus with complete and early recovery, and with no permanent pulmonary damage (H1, H18, H23). Hæmorrhagic infarction may occur followed either by recovery (H17, H8) or by formation of an abscess and then recovery (H9). In other instances abscess formation is followed by death, due probably to a complicating septicæmia (H2, H5, 2H18). There may occur also a massive hæmorrhagic consolidation brought on by interference with the circulation of the affected lobe incident to an extensive thrombosis of the pulmonary artery proximal and distal to the embolus (H7, H10, 2H21).

It was observed, furthermore, that two animals may receive identically prepared emboli, but react in totally different manners (H1 and H2, H7 and H8, H9 and H10). These variations depend in some measure on individual resistance to infection, but primarily, it is believed, on differences in the immediate reaction to the infecting agent as exemplified by thrombosis within the pulmonary artery. The results would obviously be quite different if thrombosis proceeded only distally to the embolus, or proximally and distally to the embolus, or if thrombosis did not appear at all.

For a better understanding of these variable results we must turn to the question of "infarction" in pulmonary tissue. MacCallum (14) in reviewing the subject emphasizes the double vascular supply of the lungs, the pulmonary and bronchial arteries, and the free anastomoses of the pulmonary arteries, as being responsible for the difficulty encountered in producing infarction in the lung of a healthy animal. He attributes Virchow's success in producing hæmorrhagic infarction to the use of infected emboli, which combined a blocking of the pulmonary artery with a superimposed infection. He considers hæmorrhagic infarction of the lung from sterile emboli possible only when some other circumstance causes a general slowing of the circulation in the lungs, as in chronic passive congestion, of whatever cause.

From our observations it appears that in an otherwise healthy lung, as in the experimental animal, even a virulently infected embolus may produce nothing more than a mild, well-localized inflammation, all signs of which rapidly disappear without the formation of an abscess. If, however, the infected embolus precipitates a thrombosis in the branches beyond the embolus, the collateral circulation is cut off, and true infarction occurs. If the thrombosis likewise proceeds proximal to the embolus, the extensive interference with pulmonary circulation results in massive consolidation. The location of the embolus is not without importance. In animal 2H21, the embolus lodged almost at the hilus, resulting in a massive consolidation and death.

The clinical application of these experimental observations suggests that small infected emboli may readily be held up in the pulmonary circulation with little or only temporary disturbance, if the lung is otherwise normal. Under certain circumstances, however, there may be slowing of the pulmonary circulation, as in postoperative congestion of the bases of the lung, and in so-called chronic passive congestion. The arrest of a small infected embolus in an already abnormal pulmonary bed would presumably be much more likely to initiate even greater alteration and damage to the pulmonary tissue. This damage may take various forms as suggested above: a localized pneumonitis with or without abscess formation, a pneumonic infarction with or without abscess formation, or a massive

pneumonic consolidation. These same changes may be produced by a small infected embolus lodged in apparently normal pulmonary tissue, the effect depending upon the extent of the thrombosis in the pulmonary circulation initiated by the embolus.

THE TREATMENT OF THE BRONCHIAL STUMP

The treatment of the stump in lobectomy is the *bête noire* of the thoracic surgeon. Lilienthal (13) advises ligating the vessels and bronchus *en masse* and leading down to this mass a drain. Archibald (1) brings the stump to the thoracic wall through partial collapse of the latter—thus attempting to make the bronchial stump an extrapleural organ. Heuer (9) in his experimental studies crushed the rigid bronchial wall with a firmly tied strong silk ligature. Bettman (3) asserts that "it is practically impossible to close a primary bronchus permanently." The difficulty of the problem is even further enhanced by intrabronchial infection.

The excision of lobes for the recovery of specimens following the introduction of tuberculous and pyogenic emboli has enabled us to make instructive observations as to the care of the bronchial stump. In all our lobectomies, 5 for pyogenic and 10 for tuberculous specimens, perfect healing of the bronchial stump occurred without exception, often twice in the same animal and even of the primary bronchus (H23), following a closure which emphasized the following points:

There must be a minimum of trauma to the stump through the application of clamps or through rough handling with toothed forceps. No crushed tissue of any kind capable of acting as a bacteriological medium should be produced in the stump or allowed to remain there. To this end temporary closure of the bronchus, following separate division of the pulmonary artery and vein between ligatures, was effected by applying a small bulldog artery clamp which occluded the bronchus without injuring it. (Fig. 11.) The bronchus was then closed by a row of fine silk sutures placed in the peribronchial tissues on either side, inverting the edges as much as possible when the sutures were tied. The bulldog clamp was removed. A second inversion of the stump was obtained by applying a second line of sutures also in the peribronchial tissues. A third line of sutures similarly placed and invaginating the second line, completed the closure (Fig. 11). The ease with which this inversion was obtained in the experimental animal was quite surprising and unexpected (Fig. 12). The uniform healing that followed this *atraumatic* procedure suggests a possible line of development in the treatment of the bronchial stump in human lobectomy.

SUMMARY

Tuberculous emboli introduced into the jugular vein were arrested in the pulmonary circulatory bed, where they initiated pathological changes in the pulmonary tissue resulting successively in anæmia, infarction, caseation, central softening, and abscess formation. The earliest appearance of a well defined abscess following the introduction of the tuberculous embolus was on the twelfth day, whereas pyogenic emboli produced abscesses within 4 and 6 days.

The pathological changes initiated by pyogenic emboli took various forms: (1) limited consolidation about the embolus with early recovery; (2) hæmorrhagic infarction with recovery or with central softening and abscess formation; (3) massive hæmorrhagic consolidation and death.

A relative lymphocytosis accompanied the tuberculous processes in the lungs, as contrasted with a true polymorpholeucocytosis that characterized the pyogenic processes.

The embolus as such produced only slight changes in the pulse and the respiratory rates. It was only when the effect of the accompanying infection made itself felt, that is, after the lapse of 12 or 24 hours, that the pulse rate and respiratory rate became elevated (H23, H13).

Positive blood cultures were obtained in a number of instances as early as 24 hours following the introduction of pyogenic emboli. The bacteriæmia was frequently only temporary, and the animals fully recovered (H23, H18, H9). In three instances the animals died (H10, *H21*, 2H18), and a complicating septicæmia probably accounted for the death of two other animals (*H2* and H5).

The embolus, introduced with the animal in the supine position, usually followed the main current in the pulmonary artery, lodging in the left lower lobe 14 times, in the right lower lobe 11 times, in the left upper lobe twice, in the right upper lobe once, and in the right middle lobe once.

Good healing of the bronchial stump occurred in every instance following an atraumatic inversion of the stump by sutures placed in the peribronchial tissues.

The uniform and invariable pathological changes which followed the introduction of a tuberculous embolus into the jugular vein suggest that this experimental method may lend itself to a study of certain much mooted questions, such as the effect of tuberculin in establishing immunity, the pathway of tuberculous infection, the value of therapeutic agents both surgical and medical, and other like problems in the realm of tuberculosis.

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THE CANCER PROBLEM[1]

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THE CELL

"THE cell is the unit of life," said Virchow half a century ago. Cancer is a disease of the cell, and, whether the cause lies within or without the cell membrane, the change in the cell is biological in origin.

Despite the work of many investigators, a foreign organism as the cause of cancer has not been convincingly demonstrated. It is difficult to evade the fact that when cancer has extended by metastasis to a new situation, it produces the histopathological picture of the tissue in which it originated rather than that of the organ which becomes affected secondarily. If the disease were due to foreign invasion, it presumably would reproduce the type of cell of the newly invaded tissue rather than that of the primary seat of the tumor. In any event, that the substance which acts on the cell to produce malignancy becomes an inseparable constituent of the cell is shown by the dissemination of cancer, which in the human body is only accomplished by the transplantation of the malignant cell itself.

The work of Wilson, MacCarty, and others on the pathology of the malignant cell in the tissues of the living demonstrates that the greater the deviation in structure of the diseased cell from that of the normal functioning cell, the more malignant the process. For instance, the blacker a pigmented malignant growth, the less the relative malignancy, because the fully pigmented cells are more highly differentiated than the partly pigmented cells.

MacCarty calls attention to the significant fact that the greater the proportion of nucleolar material and the less the differentiation in the cytoplasm, the more malignant the growth. The lack of differentiation seen microscopically in the cancer cell would lead to the deduction that the nucleolus is the essential agent in cell growth and that function and control lie more largely in cell cytoplasm. Broders, in evolving his index of malignancy, based his prognostic observations on the relative number of differentiated to undifferentiated cells. His study and the cytological studies of MacCarty have enabled the surgical pathologist to inform the surgeon within 2 or 3 minutes, while the information is vital to the success of the operation in progress, not only that the growth is malignant but also concerning the degree of malignancy. An extensive follow-up of patients operated on for cancer has shown the accuracy of such prognostications and has brought out the important fact that in cases of cancer in Broders' Group 1 and Group 2 a high percentage of cures justifies extensive operation, while those growths in Group 4 and cancers of the so-called inflammatory type, that is, with infiltrated margins, are often more successfully treated by other methods.

In suitable cases we remove with the knife the cancerous focus and the lymphatic extensions. In the highly cellular and ill-defined growths, we attempt to destroy the cancer cell with such agents as the cautery, surgical diathermy, roentgen-ray and radium, to which it is much more vulnerable than the normal cell. Besides the destruction effected by these agents, the deposition of a large amount of connective tissue which more or less surrounds the malignant process is induced, cutting off blood supply and encapsulating malignant cells. In structure and function this connective tissue resembles the connective-tissue stroma of the tumor with which nature is attempting to restrain the advance of the disease. In proportion to the success of the encapsulation and the degree of deprivation of nourishment, the growth is rendered innocuous temporarily or permanently.

Bowing and Desjardins have shown, as a result of treatment by radium and roentgen-ray, that cancers of Grade 4 and Grade 3 may take on the more favorable aspects of cancers of Grade 2 and Grade 1. Working with roentgen-ray on the vitamins in cancer, Burrows obtained the same result.

[1] Read before the Congress of the American College of Surgeons, Montreal, October 25-29, 1926.

Surgeons have properly laid stress on the time factor in the treatment of cancer, that is, treatment in the early stage of the disease, but they must take into serious consideration also the factor of the degree of malignancy.

COMBUSTION

Life is maintained in the cell by combustion, a molecular exchange in the colloids of the cell. The oxidation of carbon and hydrogen within the body, which gives rise to heat and energy, is the outstanding feature of all animal life, but while the normal cell functions within normal limits, the carcinomatous cell oxidizes without control and without function. The analogy between the great growth of the fertilized ovum and the growth of cancer has often been pointed out. The growth of the one, however, is orderly and with purpose, of the other disorderly and without purpose.

There are two theories of combustion, the iron-activation theory of oxidation of Warburg, and the activation-of-hydrogen theory of Wieland. In his presidential address at a recent meeting of the International Physiological Congress, Hopkins said that fundamentally the two theories are not necessarily antagonistic. He gives the weight of his authority to Wieland's theory as best explaining the chemistry of biological processes.

Since uncontrolled combustion of food material is the most important feature of the growth of cancer, it is worth while to consider how combustion is normally controlled. A pound of sugar burned inside the body at the temperature of 37 degrees C. produces the same amount of heat and energy as if oxidized without the body at a comparatively high temperature, above 400 degrees C. The chemist has long searched for an explanation of this phenomenon. Recent fine chemical researches by Hopkins and by Kendall have indicated that certain catalysts which control combustion in the body contain an atom of sulphur within their molecule, such, for instance, as glutathione and cystin.

Three types of food are oxidized in the body: carbohydrates, fats, and proteins. Carbohydrate is burned in the form of glucose ($C_6H_{12}O_6$); the oxidized carbon is passed off as carbon dioxide in respiration, the oxidized hydrogen as water. The animal fats, of which tristearin is most common, are all quite similar in composition, being composed of stearic acid which contains carbon, hydrogen, and oxygen in the proportion of $C_{18}H_{36}O_2$ combined with glycerin ($C_3H_8O_3$). Fats are oxidized much more slowly than glucose, by reason of the small oxygen content, but produce two and one-half times as much heat and energy as carbohydrates and proteins by reason of their greater carbon and hydrogen content, and therefore produce more water as well. This is well exemplified in the hibernating animal during hibernation, when the temperature of the body drops to about one-half the normal, and the water, so necessary to life, as well as heat and energy, is maintained by the combustion of the autumnal fat.

If we analyze the proteins, we find the same combination of carbon, hydrogen, and oxygen as in the sugars and fats, and, also, nitrogen, which permits the deposition of form-producing elements, such as phosphorus and calcium. There is also in proteins a little sulphur. There has long been a degree of uncertainty as to the function of the sulphur. We know that it is found in the integumentary tissues, for instance the skin, which is so often the site of cancer. The hair and the nails contain a very high percentage of sulphur and are seldom involved primarily in cancer. It is interesting in this connection that keratin, which is a highly sulphurized substance, is sometimes found in tumors, usually in the form of hyalin, which indicates reduction of the malignancy.

The oxidation of iron, ordinarily called rust, is largely due to the sulphur contained in the iron. Steel which is nearly freed from sulphur by newer processes of smelting is practically rustless.

Kendall's demonstration of the catalytic action of sulphur in the control of oxidation may explain a chemical phase of cancer development.

There are various substances, the best known of which are colloid lead, colloid gold, and the Coley serum, which appear to act as protoplasmic poisons and delay or prevent combustion by their destructive effect on

the nuclear material of the cells. Bell found that in the great lead works at Liverpool, men and women often became more or less sterile, that pregnant women apparently were subjected to abnormal risks of miscarriage, and that, in sufferers from advanced cancer who were compelled by the exigencies of life to carry on in this work, there was at times a surprising reduction in the severity of the cancerous processes.

PLANT CANCER

Cancer has been considered a disease expressed biologically as an animal reaction. There are some interesting data which appear to tie animal cancer in some of its aspects to plant life. A fanciful view of these few facts would be that under certain unknown conditions an antagonism develops between the two great divisions of life, animal and vegetable. Smith's splendid work on the parasitic origin of crown-gall cancer in plants has stimulated research as to a possible relation of plant life to animal cancer.

Warburg, in his valuable research on cancer, points out its extraordinary glycogenic action, but notes significantly that there is no increase of respiratory carbon dioxide, which should exist if rapid cancer growth were due only to oxidation of carbon. He believes that much of the abnormal power of conversion of food into cancer cells is due to fermentation, such as occurs normally in plants, for example, the action of yeasts.

The originator of a much discussed cancer cure has recently made public full particulars of the methods used in its production. He states that by means of a medium derived from plant life an organism has been cultured from cancer in man which will reproduce the disease in experimental animals. He claims further that a serum has been developed from animals immunized to these supposed cancer organisms which has value in the treatment of cancer in man. These claims should be investigated without prejudice to learn whether they have even a modicum of truth. The need of the patient suffering from cancer is too great to permit delay in search for the truth, no matter how much we may deplore the ethics of those heretofore concerned in the attempt to exploit human suffering for commercial gain.

CHRONIC IRRITATION

It is a comfort to turn from the hypothetic side of the cancer problem to the one fact about which we have knowledge, that is, the relation of chronic irritation to cancer, although we do not understand the mechanism by which the relation is brought about.

Does chronic irritation result in a wearing out of the protective tissues of the body, which, failing to reproduce sound cells, attempt to use embryonic cells as replacements and eventually lose power of control over them? Or does chronic irritation prematurely age tissues by overwork and produce a condition closely resembling the senile conditions which so often lead to cancer in the aged? Or do defects in the covering tissues of the body permit the entrance of some noxious agent into the human economy from the outside, which incites the malignant disease? Let us hope it is the latter. We need not fear the eventual triumph of a foreign foe. We do know that, at least indirectly, chronic irritation is the known factor of the greatest importance in the causation of cancer. Perhaps biochemical examinations of the tissues of the body and the fluids of patients who have suffered for years from chronic irritation without the production of cancer, and their comparison with the chemical processes of patients who have extensive cancer might give a clue to the cause of the disease.

IMMUNITY

It is interesting to speculate on whether the degree of malignancy of cancer is wholly dependent on the causative agent which lies behind the cancerous process, or whether it is in part, perhaps in great part, controlled by powers of immunity exercised through the chemical reaction of the patient's antibodies.

We must believe that under the normal conditions of life the tissues of the average human body possess more or less immunity to malignant disease. It seems quite probable that 80 per cent of persons under ordinary circumstances will not develop cancer. Estimating that 10 per cent of the deaths of per-

sons in middle and later life are due to cancer, why have not the other 90 per cent of the population at similar age-periods developed cancer? Is freedom from cancer due to accident, or do those who escape the disease possess superior immunity to its cause or causes?

The work of Maude Slye is of the greatest interest in the study of cancer. She is able to breed at will mice that will not develop cancer under ordinary conditions, and others that possess immunity under the most unfavorable conditions, even when subjected to painting with tar that has been previously activated by intense heat. In other experiments, scientifically-bred mice are born with cancer, the result of ordinary physiological wear and tear of intra-uterine life. While such breeding experiments cannot be carried out in the human being, even by the most ardent advocates of the application of eugenics, the investigation certainly affords suggestions of value.

The work of Gye and Barnard, if confirmed by further experimentation, will greatly advance our knowledge of immunity to cancer. Gye was able to develop from the fowl sarcoma of Rous two complementary filtrates: Filtrate 1, a particulate body which he believed to be a living organism, and Filtrate 2, a non-particulate, which he called the "specific factor." He believed that the first filtrate contained a foreign micro-organism and that the second was an activating fluid. If the two were injected together into fowls, cancer was produced, but if Filtrate 1 was injected without Filtrate 2, which we might call the soil-changer, cancer would not develop. If the infectivity of a previously infective Rous cancer fluid (Filtrates 1 and 2 combined) was reduced, as with chloroform, until it would not be transplanted, and more of Filtrate 2 was then added, cancer transplantation would follow. Gye's second observation was that he could substitute for Filtrate 1 of the Rous tumor a virus obtained from true malignant new-growths of the mouse, the rat, and of man, and that this substituted virus together with the specific factor, Filtrate 2, from the Rous tumor would produce sarcoma in the fowl. Other investigators have not been able to confirm Gye's work fully.

The experiments of Slye and of Gye at once focus attention on the problem of immunity, and logically lead to the idea of cancer prevention. Science has been able to develop soil-changers in smallpox, diphtheria, and tetanus. Why not in cancer? Because of natural immunity to the disease, relatively only a small proportion of the total population is susceptible to scarlet fever. With Dick's serum the degree of natural immunity of the individual to scarlet fever can be determined, and if it is not sufficient to protect from the disease, it can be increased to normal by serum. Why not in cancer? Perhaps the development of cancer as well as its degree of malignancy is attributable to the diminished activity of immunizing processes rather than to the nature of the activating agent.

THE RELATION OF POSTOPERATIVE ACHLORHYDRIA TO THE CURE OF GASTRIC AND DUODENAL ULCERS[1]

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THE treatment of gastric and duodenal ulcers both from the medical and from the surgical point of view is a subject of such vast magnitude that it would be absolutely futile to attempt even a cursory presentation of all its various phases. Not only do physicians differ widely as to the proper medical treatment of gastric and duodenal ulcers, but surgeons also have failed to agree upon the best surgical procedure. There is a growing tendency among surgeons to agree that gastric ulcers should be removed by excision with or without an added gastro-enterostomy, by sleeve resection, or by partial gastrectomy; whereas the majority of surgeons still insist that gastro-enterostomy is the preferred method of operative treatment of duodenal ulcers.

The impetus for a more radical procedure in the surgical treatment not only of gastric but also of duodenal ulcers came from Europe. Haberer (4) in 1920 reported 80 cases of gastric, duodenal, and gastrojejunal ulcers, all treated by partial or subtotal gastrectomy. He has since reported 929 cases (5). Besides other large series published recently, Eiselsberg (1) reports 691 cases, Friedemann (3), 598 cases, and Finsterer (2), 503 cases.

It may be of interest to present before this Society the experience of the gastro-enterological surgical service of Mount Sinai Hospital, a group service organized 13 years ago. In the early years of this period gastric ulcers were treated by excision with or without gastro-enterostomy or by sleeve resection. The end-results obtained by these more conservative operations were so bad that partial or subtotal gastrectomy was soon adopted as the method of choice in the treatment of *gastric* ulcers. Patients thus treated have given the most excellent end-results, the observation time being up to 12 years. They are perfectly strong and healthy without any gastric complaints. We have never observed a gastrojejunal ulcer following a partial or subtotal gastrectomy.

What was our experience during the same period with the duodenal ulcers in which gastro-enterostomy with or without pyloric exclusion was the method of choice? We had been for some years under the impression that the results were not satisfactory. A large number of patients returned to our follow-up clinic complaining of the same or even worse symptoms than those which had brought them originally to the surgical service.

Whenever we made rounds on the medical service we found a large number of patients who were suffering from severe epigastric distress in spite of the fact that a gastro-enterostomy had been performed. Our medical colleagues at the hospital preferred to advise medical treatment to patients suffering for many years from a non-obstructing duodenal ulcer rather than to turn them over to the surgical service as they were—and justly so—very much dissatisfied with the results of gastro-enterostomy.

A careful survey of gastro-enterostomies performed on this service between 1915 and 1920 (9) for pyloric and duodenal ulcer showed that only 50 per cent of the patients were cured and that 34 per cent suffered from the most serious complication of gastro-enterostomy, that is, gastrojejunal ulcer. In 18 per cent of these cases gastrojejunal ulcers were proven to be present by re-operation. In another 16 per cent the clinical and X-ray findings were those of gastrojejunal ulcer. We know that with the aid of a careful roentgen examination the correct diagnosis of gastrojejunal ulcer can be made in about 90 per cent of the cases. Therefore it is fair to assume that re-operation would have confirmed the diagnosis in practically every case, if the patients had consented to re-operation.

It does not seem fair to include in statistics on gastrojejunal ulcers only those cases which came to re-operation, as has been the custom of different authors on this subject. A statistical study based on these cases alone gives

[1] Read before the American Gastro-Enterological Association, Atlantic City, May 3, 1926.

a distorted impression on the frequency of gastrojejunal ulcers.

We are sure that a careful study of end-results from different clinics will show that 5 per cent, the figure usually quoted in the literature for the incidence of gastrojejunal ulcers, is much too low. Strauss (12) has recently stated that gastrojejunal ulcers occurred in 20 to 30 per cent of the cases; and Meyer, quoted by Strauss, found them in 25 per cent.

The frequency of gastrojejunal ulcers and the persistence of duodenal ulcers following gastro-enterostomy, which we observed in a considerable number of cases, led to the abandonment by us of gastro-enterostomy and its replacement by partial or subtotal gastrectomy in practically every case. This new policy was instituted on November 1, 1922, and has been followed consistently ever since. However, the observation time of up to 3½ years may not be long enough for definite figures as to end-results. Statistics of this type cannot be very definite, unless they cover a period of observation extending over at least 5 years.

Nevertheless, we are prepared to state that the percentage of cures has been raised from 50 per cent to about 90 per cent by substituting partial or subtotal gastrectomy for gastro-enterostomy in the surgical treatment of duodenal ulcers.

It seems undoubtedly a rather formidable procedure to remove one-half or even two-thirds of the stomach in the presence of a gastric or duodenal ulcer which is often not more than ½ centimeter in diameter. However, experience has shown that the mode of procedure should not be selected according to the size of the ulcer. Ulcers large or small should be subjected to the same operative method, that is, partial or subtotal gastrectomy.

The reason for the excellent results following partial or subtotal gastrectomy seems to lie in the fact that an immediate and permanent achlorhydria is established in the majority of cases. Lorenz and Schur (11) in 1922 showed that hyperacidity is changed into achlorhydria in a very large percentage of gastric resections.

Both physicians and surgeons agree that our therapeutic measures in the treatment of gastric and duodenal ulcers should be directed toward a marked reduction of the hyperacidity. There is no doubt that by medical treatment gastric hyperacidity may be reduced temporarily. However, no medical procedure can establish permanent achlorhydria. As soon as the treatment is stopped, previous acid values are re-established.

It is generally assumed that gastro-enterostomy causes a marked reduction in gastric hyperacidity. In fact the curative effect of gastro-enterostomy on gastric and duodenal ulcers, which varies from 50 per cent to 90 per cent according to different statistics, is usually ascribed to the reduction of acid values following gastro-enterostomy.

In a recent paper on the effect of gastro-enterostomy on gastric acidity (10) we reported on the re-examination by Ewald test-meal of patients operated upon for gastric and duodenal ulcers between 1915 and 1920 and re-examined in 1923. The difference in the reduction of acid values following resection of the stomach when compared with gastro-enterostomy with or without excision of the ulcer was most striking; 77 per cent of the partial or subtotal gastrectomies showed achlorhydria, whereas only 3 per cent of the gastro-enterostomies showed an absence of free hydrochloric acid.

It might be opportune to explain why we confined ourselves to the Ewald test-meal instead of using the Rehfuss test. We were confronted with the problem of examining a large group of working men without inconveniencing them too much and without interfering with their work. While patients are willing to have pre-operative test-meals done, they often object to test-meals after they have left the hospital, especially when they feel well. We encountered in our re-investigations a considerable number of people who refused test-meals and would not listen to arguments about the value of these tests for the patient.

The Ewald test is of sufficient accuracy to be used in the investigation of the effects of different gastric methods of operation on the acid values. The difference between 3 per cent achlorhydria following gastro-enteros-

TABLE I.—RECORDS OF TEST-MEALS IN 85 CASES OF PARTIAL OR SUBTOTAL GASTRECTOMY FOR GASTRIC AND DUODENAL ULCER

No.	Name	Date of operation	Location of ulcer	Ewald test-meal		
				Before operation	After operation	1926
1	S. S.	Nov. 1922	Pyloric	39–64[1]	Not taken	0–35
2	D. G.	Dec. 1922	Pyloric	10–18	44–57	0–21
3	M. G.	Dec. 1922	Duodenal	12–16	14–28	9–33
4	A. P.	Dec. 1922	Gastric	20–75	0–18	0–15
5	M. B.	Jan. 1923	Duodenal	60–80	20–50	0–30
6	M. G.	Feb. 1923	Duodenal	64–85	12–18	10–39
7	B. S.	Feb. 1923	Duodenal	32–64	5–12	0–19
8	B. M.	Mar. 1923	Duodenal	26–45	Not taken	0–14
9	J. K.	Mar. 1923	Duodenal	90–140	Nothing obtained	20–37
10	C. D.	Apr. 1923	Duodenal	Not done (Bleeding ulcer)	Not taken	3–57
11	A. G.	May 1923	Pyloric	52–76	0–55	Cannot be located.
12	C. S.	May 1923	Duodenal	Nothing obtained	0–20	0–15
13	H. S.	June 1923	Duodenal	84–112	Not taken	5–22
14	S. T.	June 1923	Gastric	64–92	Not taken	0–25
15	C. I.	June 1923	Duodenal	6–61	Nothing obtained	0–17
16	C. S.	July 1923	Duodenal	68–89	25–50	42–76
17	L. E.	Aug. 1923	Gastric	48–75	0–26	Cannot be located.
18	A. S.	Aug. 1923	Duodenal	65–85	22–50	11–23
19	A. K.	Oct. 1923	Gastric	.....	0–25	Out of town.
20	L. L.	Nov. 1923	Duodenal	36–75	0–45	Cannot be located.
21	N. G.	Nov. 1923	Duodenal	Not taken	Not taken	0–12
22	A. S.	Nov. 1923	Duodenal	81–94	0–20	Refused test-meal.
23	M. A.	Nov. 1923	Duodenal	40–85	0–50	Refused test-meal.
24	D. B.	Dec. 1923	Duodenal	68–86	0–30	0–19
25	S. L.	Dec. 1923	Duodenal	35–55	0–30	0–9
26	S. G.	Dec. 1923	Duodenal	42–74	0–30	0–20
27	I. T.	Dec. 1923	Duodenal (bleeding)	Not taken	14–48	10–48
28	H. B.	Jan. 1924	Duodenal	30–65	14–36	6–40
29	J. A.	Jan. 1924	Duodenal	60–100	18–40	9–29
30	H. G.	Jan. 1924	Pyloric	45–80	0–36	0–10
31	M. S.	Feb. 1924	Duodenal	64–83	18–59	0–28
32	H. F.	Feb. 1924	Pyloric (bleeding)	Not taken	Not taken	3–25
33	B. P.	Feb. 1924	Duodenal	58–82	5–30	0–14
34	F. K.	Feb. 1924	Gastric	.....	Not taken	0–16
35	M. D.	Mar. 1924	Duodenal	50–70	0–25	0–23
36	L. F.	Mar. 1924	Duodenal	60–90	25–75	0–22
37	I. K.	Mar. 1924	Duodenal	45–65	22–40	10–55
38	H. W.	May 1924	Duodenal	15–27	0–15	Cannot be located.
39	H. B.	May 1924	Pyloric	66–81	0–30	0–15
40	B. J.	May 1924	Pyloric	60–76	0–10	Cannot be located.
41	M. C.	June 1924	Duodenal	Not taken, Pre-op. diagnosis: cholelithiasis	0–30	Very rapid emptying time, two attempts futile.
42	D. Z.	July 1924	Duodenal	75–110	73–92	22–49

[1] In this and subsequent tables the first figure refers to free acid and the second to total acidity.

TABLE I.—*Continued*

No.	Name	Date of operation	Location of Ulcer	Ewald test-meal		
				Before operation	After operation	1926
43	J. B.	July 1924	Duodenal	70–90	0–28	Cannot be located.
44	G. S.	Aug. 1924	Pyloric	60–80	30–51	24–48
45	S. G.	Sept. 1924	Duodenal	64–90	Not taken	19–62
46	A. K.	Sept. 1924	Duodenal	60–85	10–25	0–10
47	L. S.	Sept. 1924	Duodenal	37–59	Not taken	0–11
48	P. K.	Oct. 1924	Gastric	60–74	Not taken	0–10
49	J. P.	Oct. 1924	Duodenal	95–105	Refused	0–25
50	M. B.	Oct. 1924	Duodenal (with obstr'n. Œsophageal diverticulum)	.....	0–8	Not re-tested on account of diverticulum.
51	M. C.	Oct. 1924	Duodenal	94–120	Not taken	0–8
52	I. L.	Oct. 1924	Duodenal	55–75	Nothing obtained	0–15
53	O. L.	Nov. 1924	Duodenal (bleeding)	Not done	15–32	0–25
54	J. G.	Dec. 1924	Duodenal	82–94	0–10	0–16
55	J. B.	Dec. 1924	Gastric	26–54	Not taken	0–8
56	N. G.	Dec. 1924	Gastric	50–60	0–20	0–16
57	J. W.	Dec. 1924	Duodenal	Nothing obtained	14–32	0–24
58	M. F.	Dec. 1924	Duodenal	33–54	0–30	0–16
59	H. C.	Jan. 1925	Pyloric	Not taken	0–40	Cannot be located.
60	H. G.	Jan. 1925	Duodenal	10–15	0–20	Moved away.
61	M. B.	Jan. 1925	Gastric	70–90	0–35	Refused test-meal.
62	L. U.	Jan. 1925	Duodenal	70–90	0–5	0–41
63	D. S.	Feb. 1925	Duodenal	65–85	5–30	35–56
64	L. W.	Feb. 1925	Duodenal	75–95	15–60	0–21
65	A. K.	Feb. 1925	Duodenal	40–65	0–30	0–14
66	M. K.	Mar. 1925	Duodenal	80–105	44–58	5–23
67	J. B.	Mar. 1925	Duodenal	45–80	0–58	5–36
68	J. S.	Mar. 1925	Duodenal	25–55	26–38	0–26
69	U. P.	Mar. 1925	Gastric	Not taken	0–4	Has moved to Sweden.
70	B. B.	Mar. 1925	Duodenal	45–85	0–30	Cannot be located.
71	A. S.	Mar. 1925	Pyloric	25–45	10–22	0–40
72	A. K.	Apr. 1925	Duodenal (bleeding)	.....	0–20	17–29
73	P. C.	Apr. 1925	Duodenal	62–80	8–22	0–8
74	M. F.	Apr. 1925	Gastric	15–29	0–20	0–19
75	B. L.	Apr. 1925	Gastric	40–65	0–12	0–15
76	J. L.	May 1925	Duodenal	82–94	25–64	0–17
77	M. S.	June 1925	Gastric	22–29	0–15	0–15
78	L. E.	July 1925	Duodenal	80–95	Not taken	0–42
79	B. L.	July 1925	Duodenal	56–70	0–16	Refused test-meal.
80	R. P.	Aug. 1925	Duodenal	40–70	13–33	21–50
81	H. C.	Aug. 1925	Duodenal	20–62	0–32	0–16
82	J. W.	Sept. 1925	Duodenal	52–78	0–57	Cannot be located.
83	R. L.	Sept. 1925	Duodenal	62–75	28–52	11–27
84	J. R.	Sept. 1925	Duodenal	51–67	27–44	0–20
85	S. G.	Oct. 1925	Duodenal	79–97	0–37	0–28

[1] In this and subsequent tables the first figure refers to free acid and the second to total acidity.

tomy as compared with 77 per cent following partial or subtotal gastrectomy is so marked that a large hiatus would continue to exist, even if the finer Rehfuss test were employed.

Furthermore it has been our experience that whenever we compared Rehfuss and Ewald test-meals in the same patient, as we have done in a large number of cases, no marked differences in the figures for free hydrochloric acid were observed.

While the number of gastro-enterostomies which were performed between 1915 and 1920 and re-examined as to acid values in 1923 were considerable, the number of partial or subtotal gastrectomies comprised only 9 cases. They were all gastric ulcer. As stated above, gastro-enterostomy was the method of choice on this service until 3½ years ago in the surgical treatment of duodenal ulcers. The well known preponderance of duodenal ulcers as compared to gastric ulcers explains the small number of gastric resections performed during that period.

The marked numerical difference between partial or subtotal gastrectomies (9 cases) and gastro-enterostomies (69 cases) in the previous study suggested the possibility that these figures might not be confirmed were a larger number of gastric resections to be investigated as to acid values. It seemed to us of some importance to investigate the larger material now at our disposal and to ascertain whether our previous conclusions that 3 out of 4 patients show an absence of free hydrochloric acid following this major gastric operation would be confirmed.

This survey is based on 94 cases operated upon between November 1, 1922, and November, 1925, on the wards of the gastro-enterological surgical service. The large number of private patients operated upon by Doctor Berg during this period are not included in this investigation. The re-examination of these patients by test-meal would have been too difficult, as they are not included in our follow-up system.

Eight patients were women (8.5 per cent), 86 (91.5 per cent) were men. None of the innumerable theories about the causation of gastric and duodenal ulcers has ever adequately explained why ulcers occur so rarely in women. It is often stated that ulcers when occurring in women are located in the stomach and not in the duodenum. Our series of 8 ulcers in women showed 2 in the body of the stomach, 1 in the pylorus, and 5 in the duodenum.

In these 94 patients the ulcer was located in the body of the stomach in 14 cases, at the pylorus in 11 cases, and in the duodenum in 69 cases (73 per cent). The large percentage of duodenal ulcers in our statistics as compared with gastric and pyloric ulcer is in accord with other statistical reports on this subject.

Nine patients could not be included in this survey. It is our custom to take a postoperative test-meal on our gastric resections for ulcer on the day of their discharge (usually on the sixteenth day after operation). In these 9 cases the test-meal had not been taken or the patient had refused to have a stomach tube passed. The patients did not return for re-examination. Some could not be located, 2 had moved to foreign countries, and others refused the test-meal. As these cases had neither a postoperative nor a follow-up test-meal, they could not be included in this survey.

Thus we have 85 cases which may throw some light on the question of the reduction of acid values following partial or subtotal gastrectomies. They are tabulated in the accompanying tables.

Table I shows a general review of the 85 patients under discussion.

In order to simplify a study of this material we have grouped the cases in the following manner:

	Cases
Table II—Achlorhydria upon discharge and upon re-examination	18
Table III—No test-meal upon discharge; achlorhydria upon re-examination	13
Table IV—Achlorhydria upon discharge; no re-examination	18
Table V—Presence of free hydrochloric acid upon discharge; achlorhydria upon re-examination	15
Table VI—Presence of free hydrochloric acid upon discharge and upon re-examination	14
Table VII—No test-meal upon discharge; presence of free hydrochloric acid upon re-examination	5
Table VIII—Achlorhydria upon discharge; presence of free hydrochloric acid upon re-examination	2

Table II presents 18 patients who showed absence of free hydrochloric acid when they

TABLE II.—ACHLORHYDRIA UPON DISCHARGE AND UPON RE-EXAMINATION

No.	Name	Date of operation	Location of ulcer	Ewald test-meal		
				Before operation	After operation	1926
4	A. P.	Dec. 1922	Gastric	20–75	0–18	0–15
12	C. S.	May 1923	Duodenal	Nothing obtained	0–20	0–15
24	D. B.	Dec. 1923	Duodenal	68–86	0–30	0–19
25	S. L.	Dec. 1923	Duodenal	35–55	0–30	0–9
26	S. G.	Dec. 1923	Duodenal	42–74	0–3	0–20
30	H. G.	Jan. 1924	Pyloric	45–80	0–36	0–10
35	M. D.	Mar. 1924	Duodenal	50–70	0–25	0–23
39	H. B.	May 1924	Pyloric	66–81	0–30	0–15
54	J. G.	Dec. 1924	Duodenal	82–94	0–10	0–16
56	N. G.	Dec. 1924	Gastric	50–60	0–20	0–16
58	M. F.	Dec. 1924	Duodenal	33–54	0–30	0–16
62	L. U.	Jan. 1925	Duodenal	70–90	0–5	0–41
65	A. K.	Feb. 1925	Duodenal	40–65	0–30	0–14
74	M. F.	Apr. 1925	Gastric	15–29	0–20	0–19
75	B. L.	Apr. 1925	Gastric	40–65	0–12	0–15
77	M. S.	June 1925	Gastric	22–29	0–15	0–15
81	H. C.	Aug. 1925	Duodenal	20–62	0–32	0–16
85	S. G.	Oct. 1925	Duodenal	79–97	0–37	0–28

were discharged from the hospital and when they were retested 3 months to 3 years after their discharge. It is interesting to note the marked drop from a pre-operative hyperacidity to a postoperative achlorhydria. In 5 cases the pre-operative figure for free hydrochloric acid varied between 66 and 79. Yet when they were re-tested 2½ weeks after a partial or subtotal gastrectomy, hyperacidity had changed into complete absence of free hydrochloric acid.

Table III comprises 13 patients who for various reasons had had no test-meal taken upon their discharge. Some refused the test, others had not recovered sufficiently from the operation to make a test-meal advisable. In a few cases the taking of a test-meal before the discharge was inadvertently omitted. These 13 cases showed achlorhydria in the follow-up examination 5 months to 3 years after operation. Three patients of this group had a very marked pre-operative hyperchlorhydria, figures for free hydrochloric acid being recorded as 80, 94, and 95 respectively.

TABLE III.—NO TEST-MEAL UPON DISCHARGE; ACHLORHYDRIA UPON RE-EXAMINATION

No.	Name	Date of operation	Location of ulcer	Ewald test-meal	
				Before operation	1926
1	S. S.	Nov. 1922	Pyloric	30–64	0–35
8	B. M.	Mar. 1923	Duodenal	26–45	0–14
14	S. T.	June 1923	Gastric	64–92	0–25
15	C. I.	June 1923	Duodenal	6–61	0–17
21	N. G.	Nov. 1923	Duodenal	Not taken	0–12
34	F. K.	Feb. 1924	Gastric	Not taken	0–16
47	L. S.	Sept. 1924	Duodenal	37–59	0–11
48	P. K.	Oct. 1924	Gastric	60–74	0–10
49	J. P.	Oct. 1924	Duodenal	95–105	0–25
51	M. C.	Oct. 1924	Duodenal	94–120	0–8
52	J. L.	Oct. 1924	Duodenal	55–75	0–15
55	J. B.	Dec. 1924	Gastric	26–54	0–8
78	L. E.	July 1925	Duodenal	80–95	0–42

In Table IV we have presented 18 cases which showed absence of free hydrochloric acid at the time of discharge from the hospital. However, for various reasons we were not able to check up these figures in our follow-up clinic. Some had moved away from this city, others could not be located, as they had changed their addresses. Five patients of this group returned to the follow-up clinic, but would not consent to a test-meal. In Case 41, two attempts to obtain a test-meal were futile on account of rapid emptying time of the stomach. The patient is perfectly well at present.

Can we assume that these 18 patients have kept the postoperative achlorhydria? During the progress of this investigation our results obtained by re-examination seemed to indicate that an achlorhydria following a partial or subtotal gastrectomy is a permanent condition. However, we encountered recently 2 cases (Table VIII) which in spite of the fact that they had complete absence of free hydrochloric acid upon discharge from the hospital, showed presence of free hydrochloric acid upon re-examination 9 months after the operation. The figures for free hydrochloric acid were 5 and 17 respectively. Both patients are perfectly well and have gained considerable weight since the operation. Both test-meals

TABLE IV.—ACHLORHYDRIA UPON DISCHARGE; NO RE-EXAMINATION

No.	Name	Date of operation	Location of ulcer	Ewald test-meal	
				Before operation	After operation
11	A. G.	May 1923	Pyloric	52–76	0–55
17	L. E.	Aug. 1923	Gastric	48–75	0–26
19	A. K.	Oct. 1923	Gastric	Not taken	0–25
20	L. L.	Nov. 1923	Duodenal	36–75	0–45
22	A. S.	Nov. 1923	Duodenal	81–94	0–20
23	M. A.	Nov. 1923	Duodenal	40–85	0–50
38	H. W.	May 1924	Duodenal	15–27	0–15
40	B. J.	May 1924	Pyloric	60–76	0–10
41	M. C.	June 1924	Duodenal	Not taken, pre-op. diagnosis: cholelithiasis	0–30
43	J. B.	July 1924	Duodenal	70–90	0–28
50	M. B.	Oct. 1924	Duodenal. Œsoph. Div.	Not taken	0–8
59	H. C.	Jan. 1925	Pyloric	Not taken	0–40
60	H. G.	Jan. 1925	Duodenal	10–15	0–20
61	M. B.	Jan. 1925	Gastric	70–90	0–35
69	U. P.	Mar. 1925	Gastric	Not taken	0–4
70	B. B.	Mar. 1925	Duodenal	45–85	0–30
79	B. L.	July 1925	Duodenal	56–70	0–16
82	J. W.	Sept. 1925	Duodenal	52–78	0–57

were repeated in order to make sure of these rather unexpected findings. We are at a loss at present to explain this interesting observation.

In view of these two observations we must state that there might be a chance of about 2.5 per cent error if we assume that these 18 cases would have presented achlorhydria if they could have been subjected to another test-meal. As can be readily seen, however, this error (2.5 per cent of 18 cases) would not change the figures as presented in Table IV.

Table V shows 15 patients with a moderate amount of free hydrochloric acid when they left the hospital and achlorhydria upon re-examination. It is very natural that we cannot expect hyperacidity to change in every case immediately into achlorhydria in the short period of 2½ weeks. Case 2 had a much higher rate of free hydrochloric acid after the operation (44) than before the operation (10). However, in view of the fact that achlorhydria was present upon re-examination, it is probable that an error occurred in the examination of the postoperative test-meal.

TABLE V.—PRESENCE OF FREE HYDROCHLORIC ACID UPON DISCHARGE; ACHLORHYDRIA UPON RE-EXAMINATION

No.	Name	Date of operation	Location of ulcer	Ewald test-meal		
				Before operation	After operation	1926
2	D. G.	Dec. 1922	Pyloric	10–18	44–57	0–21
5	M. B.	Jan. 1923	Duodenal	60–80	20–50	0–30
7	B. S.	Feb. 1923	Duodenal	32–64	5–12	0–19
31	M. S.	Feb. 1924	Duodenal	64–83	18–59	0–28
33	B. P.	Feb. 1924	Duodenal	58–82	5–30	0–14
36	L. F.	Mar. 1924	Duodenal	60–90	25–75	0–22
46	A. K.	Sep. 1924	Duodenal	60–85	10–25	0–10
53	O. L.	Nov. 1925	Duodenal (bleeding)	Not done	15–32	0–25
57	J. W.	Dec. 1924	Duodenal	Nothing obtained	14–32	0–24
64	L. W.	Feb. 1925	Duodenal	75–95	15–60	0–21
68	J. S.	Mar. 1925	Duodenal	25–55	26–48	0–26
71	A. S.	Mar. 1925	Pyloric	25–45	10–22	0–40
73	P. C.	Apr. 1925	Duodenal	62–80	8–22	0–8
76	J. L.	May 1925	Duodenal	82–94	25–64	0–17
84	J. R.	Sept 1925	Duodenal	51–67	27–44	0–20

It may be of interest to point out that all ulcers of this group were located either in the pylorus or duodenum. In all cases of gastric ulcers, an immediate and permanent achlorhydria was established. This very interesting point will be discussed later somewhat more in detail.

In 14 cases (Table VI) free hydrochloric acid was present after the operation and at re-examination. In 3 cases the figures of the follow-up test-meal were higher than those recorded at the time of the patient's discharge. In one of these patients a Billroth I had been performed. It is very possible that part of the antrum was left *in situ*.

The 5 cases in Table VII had no test-meal taken upon their discharge from the hospital and showed presence of free hydrochloric acid upon re-examination. In 2 of these cases a pre-operative test-meal was not taken as they were suffering from acute duodenal ulcers with profuse hæmorrhages. In the other 3 cases a marked hyperacidity was recorded in the pre-

TABLE VI.—PRESENCE OF FREE HYDROCHLORIC ACID UPON DISCHARGE AND UPON RE-EXAMINATION

No.	Name	Date of operation	Location of ulcer	Ewald test-meal		
				Before operation	After operation	1926
3	M. G.	Dec. 1922	Duodenal	12–16	14–28	9–33
6	M. G.	Feb. 1923	Duodenal	64–85	12–18	10–39
16	C. S.	July 1923	Duodenal	68–89	25–50	42–76
18	A. S.	Aug. 1923	Duodenal	65–85	22–50	11–23
27	I. T.	Dec. 1923	Duodenal (bleeding)	Not taken	14–48	10–48
28	H. B.	Jan. 1924	Duodenal	30–65	14–36	6–40
29	J. A.	Jan. 1924	Duodenal	60–100	18–40	9–29
37	I. K.	Mar. 1924	Duodenal	45–65	22–40	10–55
42	D. Z.	July 1924	Duodenal	75–110	73–92	22–49
44	G. S.	Aug. 1924	Pyloric	60–80	30–51	24–48
63	D. S.	Feb. 1925	Duodenal	65–85	5–30	35–56
66	M. K.	Mar. 1925	Duodenal	80–105	44–58	5–23
80	R. P.	Aug. 1925	Duodenal	40–70	13–33	21–50
83	R. L.	Sept. 1925	Duodenal	62–75	28–52	11–27

TABLE VII.—NO TEST-MEAL UPON DISCHARGE; PRESENCE OF FREE HYDROCHLORIC ACID UPON RE-EXAMINATION

No.	Name	Date of operation	Location of ulcer	Ewald test-meal	
				Before operation	1926
9	J. K.	Mar. 1923	Duodenal	90–140	20–37
10	C. D.	April 1923	Duodenal (bleeding)	Not done	3–57
13	H. S.	June 1923	Duodenal	84–112	5–22
32	H. F.	Feb. 1923	Duodenal (bleeding)	Not taken	3–25
45	S. G.	Sept. 1924	Duodenal	64–90	19–62

TABLE VIII.—ACHLORHYDRIA UPON DISCHARGE; PRESENCE OF HYDROCHLORIC ACID UPON RE-EXAMINATION

No.	Name	Date of operation	Location of ulcer	Ewald test-meal		
				Before operation	After operation	1926
67	J. B.	March 1925	Duodenal	45–80	0–58	5–36
72	A. K.	April 1925	Duodenal (bleeding)	.....	0–20	17–29

operative test-meal. They showed a considerable drop (90 to 20, 84 to 5, and 64 to 19) when re-examined 2½, 2, and 1½ years after the operation. It is very probable that these patients would show achlorhydria should they be re-tested in 1927 or 1928. In some cases of partial or subtotal gastrectomy the downward curve from hyperacidity to achlorhydria travels very gradually. This point is illustrated very well by a case reported in a previous paper (8). This man had been operated upon in 1920. Before the operation the figures were 57–70. When re-examined in 1923 he showed 12–28. Upon a recent re-examination (1926) he showed absence of free hydrochloric acid (0–11). In other words it took over 3 years and possibly 6 years to effect a postoperative achlorhydria in this patient. This man has been perfectly well since the subtotal gastrectomy.

It is very possible that many of the 19 cases represented in Table VI and Table VII would show achlorhydria if they were subjected to another test-meal at a later date.

A perusal of these test-meal figures shows that 64 among 85 patients operated upon between 1922 and 1925 had achlorhydria upon their discharge from the hospital or when they were re-examined in 1926, a percentage of 75 per cent. This figure is practically identical with that (77 per cent) observed in partial or subtotal gastrectomy between the years 1915 and 1920 (10). Thus during an observation time of 8 years, we found achlorhydria following partial or subtotal gastrectomy in about 75 per cent of the cases.

Eight cases showed low figures for free hydrochloric acid, that is, figures below 10. Thus 84 per cent of our cases had either complete achlorhydria or free hydrochloric acid in very small quantity.

A comparison of these figures with those following gastro-enterostomy will show the marked effect of partial or subtotal gastrectomy on the gastric acidity. We (10) found in a recent study of cases of gastro-enterostomy performed between 1915 and 1920 and re-examined in 1923, achlorhydria in 2 cases among 69 gastro-enterostomies. In 3 more cases free hydrochloric acid below 10 was

present. Thus 3 per cent following gastro-enterostomy showed achlorhydria and 7 per cent acid figures below 10; 75 per cent and 84 per cent as compared with 3 per cent and 7 per cent!

The explanation for this marked reduction in the figures for free hydrochloric acid following resection of the stomach is not quite clear. It is well known that the acid producing glands are situated in the fundus and body of the stomach. It is assumed that a hormone is produced in the antrum which activates the acid glands. In other words, the motor power for the acid-producing glands is in the antrum. This seems to explain the marked drop in acid figures following partial or subtotal gastrectomy.

We are well aware of the fact that complete absence of free hydrochloric acid in the gastric contents is generally not considered with favor by the internists. However, it is beyond doubt that achlorhydria following partial or subtotal gastrectomy does not interfere in the least with the well-being of the patients.

Partial or subtotal gastrectomy gives excellent clinical results in the vast majority of the cases (observation time 12 years). In support of this statement we have not only the experience of this service, but the experience in thousands of cases, collected in different parts of the world.

As is very often the case in the progress of medicine, practical experience led the way and the scientific explanation followed subsequently. Haberer had already performed subtotal gastrectomies on duodenal ulcers for a number of years when Lorenz and Schur (11) pointed out the importance of achlorhydria for the permanent cure of ulcers of the stomach and duodenum.

We have never seen pernicious anæmia develop as a sequel to partial or subtotal gastrectomy for gastric or duodenal ulcer.

Ferments were studied in 21 among our 64 cases of postoperative achlorhydria, with the following results: Ferments were present in normal quantity in 15 per cent, absent in 35 per cent, and diminished in 50 per cent of the cases. It would carry us too far to enter into a minute discussion of this rather involved subject.

Achlorhydria is not synonymous with achylia gastrica. In achlorhydria, free hydrochloric acid is absent, whereas in achylia gastrica both free and combined hydrochloric acid are absent.

Histamin may differentiate between the true and false form of achylia. However, the injection of histamin is not without danger. Histamin was administered to a patient in the gastro-enterological dispensary of the hospital and the injection was followed immediately by a marked depression in the blood pressure, fainting, vomiting, etc. These symptoms lasted for a few hours. On account of these alarming symptoms we preferred not to use histamin in studying our ambulatory follow-up cases.

A neutral red test was performed in a number of the cases in which the presence of an achlorhydria had been previously determined. In the cases thus far studied there was apparently no excretion of neutral red during a period of observation of 1½ to 2 hours.

Another problem, aside from the chemical question (postoperative achlorhydria) which we have discussed in this paper, is involved in the radical surgical treatment of gastric and duodenal ulcers by partial or subtota gastrectomy. Konjetzny (7) and Kalima (6) have shown that in ulcer cases the distal half of the stomach shows a chronic gastritis which is a predisposing factor for ulcer formation. Gastro-enterostomy does not remove this area and ulcers can form and will form in the stomach or duodenum and at the new stoma in spite of the presence of a gastro-enterostomy. Partial or subtotal gastrectomy removes the whole inflammatory area and thus prevents further trouble.

We have learned from our experience that an immediate postoperative achlorhydria is most desirable. We feel that when a patient leaves the hospital with an absence of free hydrochloric acid, he is not going to have any recurrence of symptoms. Patients in whom this achlorhydria has not been established require close watching for possible recurrences.

How large a portion of the stomach should be resected in order to establish a permanent achlorhydria? It is impossible to make any fixed rules, as the normal size of the stomach

varies considerably. It is advisable to remove the pylorus and about 10 centimeters along the lesser curvature. The line of dissection should be carried just proximal to the re-entrant angle. It is very possible that the re-entrant angle carries a nerve center which is of great importance in the mechanism of acid production.

It is very interesting to note that all resections for *gastric* ulcer (13 cases) showed immediate and permanent achlorhydria following subtotal gastrectomy. Only 1 among 9 pyloric ulcers showed free hydrochloric acid (11 per cent). On the other hand 20 among 63 duodenal ulcers (32 per cent) had free hydrochloric acid following resection of the stomach. In other words, with the exception of 1 case of pyloric ulcer free hydrochloric acid following resection of the stomach was found only in cases of duodenal ulcer.

A probable explanation for these findings is that in gastric ulcers, which are usually located midway between cardia and pylorus and which are surrounded by an inflammatory area of considerable size, the line of dissection must be carried high up in order to insure a safe closure of the upper end of the stomach. On the other hand in duodenal ulcers we are apt to leave *in situ* a considerable portion of the stomach and thus fail to produce achlorhydria.

The great importance which we attribute to the postoperative achlorhydria in relation to the permanent cure of ulcers has induced us to abandon the Billroth I method. A Billroth I operation requires an anastomosis between resected stomach and duodenum. In performing this operation, the surgeon is apt to make his line of dissection nearer the pylorus in order to safeguard his anastomosis and thus fail to produce an achlorhydria. For this reason the Billroth II method is used at present exclusively on this service.

We pointed out in a previous communication (10) that simple pylorectomy does not produce achlorhydria. Pylorectomized patients (Billroth II) are subject to gastrojejunal ulcers just as frequently as gastro-enterostomized patients. We have observed in this hospital 4 cases of gastrojejunal ulcers following pylorectomy.

We have never seen a gastrojejunal ulcer develop in a patient who had complete absence of free hydrochloric acid.

Before closing we would like to refer to an interesting group of cases published recently (10). Nine cases in which either a pylorectomy or gastro-enterostomy with or without excision of the ulcer was performed in this hospital required a subtotal gastrectomy for gastrojejunal or recurrent gastric or duodenal ulcer. In 2 of these no test-meal was taken before the subtotal gastrectomy. Seven showed free hydrochloric acid in the Ewald test-meal.

All of these 9 cases showed achlorhydria following the subtotal gastrectomy. They are perfectly well at present (observation time 2 to 8 years).

We hope to have demonstrated in this presentation that partial or subtotal gastrectomy in the surgical treatment of gastric and duodenal ulcers was adopted on this service only after gastro-enterostomy had proved to be a failure in a very large number of cases. In fact, we hesitated a long time before adopting the undoubtedly more radical procedure. However, gastro-enterostomy does not give the patient a square deal. A surgical procedure which is a failure in 1 out of 2 cases we feel should certainly not be used as a routine measure.

We and our patients have been greatly pleased with the clinical results following partial or subtotal gastrectomy. There probably are a great variety of factors which contribute to the large percentage of cures following this method. Among these factors the establishment of a permanent achlorhydria plays undoubtedly a very great rôle.

We hope that further investigations by different authors will confirm these observations on the importance of a postoperative achlorhydria in the successful treatment of gastric and duodenal ulcers.

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INCIDENCE OF CARCINOMA OF THE UTERUS AMONG JEWISH WOMEN[1]

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WILLIAMS states that although the comparative pathology of the Jew has been fully worked out for most diseases, with regard to malignant tumors, the data are scanty, and leave much to be desired.

Although most authorities agree that cancer of the uterus among Jewish women is comparatively less common than among Gentile women, there are a few who question such conclusions from the data given. F. Theilhaber quotes A. Theilhaber's figures as follows: Of 228 patients with fibromyoma of the uterus, 43, 19.1 per cent, were Jewesses; while of 133 with carcinoma of the cervix, 1, 0.75 per cent, were Jewesses. In Budapest, in 1906, 16,380 deaths were reported, and of these 2,500, 15 per cent, were among Jews. The Jewish mortality from carcinoma, excepting carcinoma of the uterus, was 27 per cent of the total mortality but only 8.05 per cent of Jews died from carcinoma of the uterus. The high percentage of mortality from carcinoma is explained by Theilhaber by the fact that a much greater number of Jews reach the cancer age. Between 1902 and 1906, inclusive, 783 persons died from carcinoma of the uterus in Budapest. Of this number only 68, 8.7 per cent (were Jewesses) although the total mortality from carcinoma among Jews for the 5 years was 19.5 per cent.

F. Theilhaber also quotes Kirschner's figures from Munich where between 1876 and 1908, 185 Jews died from carcinoma; of these 98 were females. Seven (about 7 per cent) died from carcinoma of the uterus. In general, carcinoma of the uterus is given as causing 25 to 35 per cent of the mortality from carcinoma, so that carcinoma among Jewesses is comparatively infrequent. This fact is still more striking when it is noted that 41 Jewesses, 42 per cent, died from carcinoma of the gastro-intestinal tract.

F. Theilhaber concludes, therefore, that among Jewesses carcinoma of the uterus is less often met with than in Gentiles, and that usually the carcinoma affects the body rather than the cervix.

Hoffman refers to Fishberg who quotes Braithwaite as to the extreme rarity of carcinoma of the uterus among the numerous Jewesses in the Leeds General Infirmary. In New York City Fishberg says the statistics of a large Christian and a large Jewish hospital bear out the fact that although carcinoma of the uterus among the Jews is not rare, it is less common than among the Gentiles. This statement, he says, has been verified by leading gynecologists of New York.

Williams quotes Fishberg as to the relative infrequency of carcinoma among Jews, which Fishberg thinks is due to the comparative rarity of carcinoma of the uterus and female breast. On the other hand Fishberg states that nearly 45 per cent of the Jewish mortality from carcinoma is accounted for by carcinoma of the gastro-intestinal tract, including carcinoma of the liver and pancreas, while only 23 per cent of Gentiles die from carcinoma of the digestive tract. Williams quotes Fishberg again as to the lower death rate from carcinoma among those of Polish extraction (mostly Jews) when compared to other national groups. This is corroborated by King's figures from the twelfth United States census, where the mortality due to malignant neoplasm was highest among those whose mothers were born in France, 92.8 for each 100,000 of white population, in Scotland 81.8, and in Germany 78.2, the lowest among those whose mothers were born in Russia and Poland 25.7, in Italy 22.8, and in Hungary and Bohemia 31.5 for each 100,000 of white population. It is interesting to note in this respect the statement of McConnell who says, in reviewing the mortality from carcinoma in the twelfth United States census, that the incidence of carcinoma among the foreign white population is greater than it is among the native white population.

[1] Submitted for publication July 22, 1926.

Williams is not convinced by Fishberg's figures for carcinoma of the uterus and breast among Jewesses, and as for the high mortality from carcinoma of the digestive tract, he thinks he can show that more than half of the "Britishers" who die from carcinoma, die from that type of carcinoma.

Bainbridge quotes figures from the London Hospital (1911) where of 3,408 Gentile women admitted, 212 (6.2 per cent) had carcinoma. Of 173 Jewesses 11 (6.4 per cent) had carcinoma. But at the same time, although not one case of carcinoma of the reproductive organs occurred in a Jewess, 8 occurred among the Gentile women. On the other hand, 90 Gentiles had carcinoma of the breast (42.4 per cent), as compared with 5 (45.4 per cent) Jewesses.

Williams quotes Richardson who states from experience with wealthy Jews of West London that he finds no difference in the character of the affection in the Jew, nor any selection of sex, nor any organic selection. Williams concludes that the liability of Jews to cancer varies with their mode of life, approximating that of the people among whom they dwell, but generally being somewhat inferior to it.

Wolff, quoted by Hoffman, thinks that carcinoma is less common among Jews and that carcinoma of the uterus is rare. Hoffman quotes figures from Budapest and Holland showing that in spite of the fact that among Gentiles there is a lower mortality from carcinoma than among Jews, Gentiles have carcinoma of the uterus three times as frequently as Jews.

Although Fishberg, who is quoted by Hoffman, thinks that carcinoma of the female breast is infrequent in Jewesses, many other writers think it is very common. Hoffman concludes that although the statistics are "contradictory and inconclusive" from the data now available, it is fairly certain that carcinoma is "relatively less common among Jews living in conformity to the orthodox principles of their faith, and that because of their poverty and simple living cancer of the uterus is less common when compared to Gentiles of corresponding social and economic status."

Wolff states that most authorities agree that married women have carcinoma of the uterus more frequently than single women. In this respect the higher fecundity and longevity of Jewesses would make the infrequency of carcinoma of the uterus all the more striking. However, Lever claims that sterile married women have carcinoma of the uterus more frequently than child-bearing women. Salaman, a more recent observer, thinks that the Jewish birth-rate is rapidly declining and is even lower than among Gentiles, but he agrees that the Jewish death rate is without exception less than the Gentile. He attributes this fact partly to the infrequency of alcoholism and syphilis among the Jews.

STATISTICS FROM THE MAYO CLINIC

For the purpose of this study all cases of primary carcinoma of the uterus (cervix or fundus) occurring in the Mayo Clinic between 1920 and 1925, inclusive, were analyzed. The diagnosis was confirmed pathologically in about two-thirds of the cases, and in the rest the diagnosis was so obvious that biopsy was not carried out. No case in which the diagnosis was at all questionable was included.

The term "Jew" was used in the same sense as that stated by Hoffman, namely, a person of the Hebrew faith. In about two-thirds of the cases the religion was definitely stated; in the majority of the rest of the cases the race was stated. Any case which was at all questionable was confirmed by consulting the hospital records or by referring to the physician who examined the patient. Since no record of the number of Jews registering at the Clinic was kept, the number was estimated from figures given in the St. Mary's Hospital Bulletin for the years 1920 to 1925, inclusive, and from figures obtained from the hospital assignment records. These figures show that about 4 per cent of the patients treated surgically at the Mayo Clinic are Jews. Since it appears that the number of Jews not treated surgically is proportionately higher than that of Gentiles, because of a large percentage of functional disease among Jews, the very conservative figure of somewhat less than 5 per cent was assumed, in calculating the number of

Jewish patients registering at the Clinic. Several officials of the Clinic who were familiar with conditions agreed that 5 per cent was quite a conservative figure (Table I.)

TABLE I.—ANALYSIS OF 1,237 CASES OF PRIMARY CARCINOMA OF THE UTERUS FROM 1920 TO 1925, INCLUSIVE

New patients registered at the Mayo Clinic (1920 to 1925, inclusive)	234,250
New Jewish patients (estimated at slightly less than 5 per cent)	11,700
Carcinoma of the uterus (Gentiles)	1,227
550 for each 100,000 registrations	
Carcinoma of the uterus (Jewesses)	10
86 for each 100,000 registrations	

ANALYSIS OF CASES OF CARCINOMA AT THE CURIE HOSPITAL FROM 1920 TO 1925, INCLUSIVE

The following data are interesting in that they show the comparative incidence of carcinoma in Jews and Gentiles and bring out more clearly the relative frequency of carcinoma of the uterus as compared with carcinoma in other regions. The Curie Hospital records are most valuable for this study because about two-thirds of the patients registered there are treated for carcinoma with radium or roentgen rays, the rest being treated for such benign conditions as dermatological diseases, menorrhagia, and benign tumors. Here, too, every patient is asked to state his religion. Most of the cases of carcinoma were definitely confirmed by pathological examination of tissue, and the rest were quite obviously carcinoma and no biopsy was thought advisable or necessary (Table II).

	All women		Jewesses	
	Number	Per cent	Number	Per cent
Average age of women with carcinoma of uterus, years	49.93		45.40	
Married women	1.02	97.0	10	100
Single women	35	3.0	0	0
Nulliparæ	124	10.3	1	10
Average number of pregnancies	4.43 in 1,078 patients		4.67 in 9 patients	

TABLE II.—SITUATION OF CARCINOMA

	Gentiles		Jews	
	Number	Per cent	Number	Per cent
Registered from 1920 to 1925, inclusive	6,630		206	
Diagnosis of carcinoma	4,402	66.0	129	62.0
Carcinoma of the uterus	727	16.5	5	3.9
Carcinoma of the breast	1,246	28.3	34	26.4
Carcinoma of the digestive tract, including liver and pancreas	753	17.1	30	30.2

SUMMARY AND CONCLUSIONS

It will be noted from the statistics of the Curie Hospital that the percentage of carcinoma in Jews is slightly lower than in Gentiles. This is in accord with the conclusions of Williams that carcinoma frequency in Jews approximates that of the people among whom they dwell, but is generally somewhat inferior to it.

Carcinoma of the uterus, according to the Curie Hospital figures, is about one-fourth as common in Jewish women as in Gentile women. This approximates the statistics from Holland and Budapest, and is in agreement with the conclusions of Hoffman and Fishberg. Carcinoma of the breast, however, is fairly frequent in Jewish women. Although the figures from the Curie Hospital do not show that the percentage of mammary carcinoma is greater in the Jewish women than in the Gentile women as some authorities state, still the figure, 26.4 per cent, as compared with 28.3 per cent in Gentile women, is contrary to Fishberg's contention that mammary carcinoma is infrequent in Jewish women.

These figures are even more interesting when it is noted that the frequency of carcinoma of the digestive tract is almost twice as great in Jews as in Gentiles. This is in accord with Fishberg's statement that nearly 45 per cent of the mortality from carcinoma in Jewish patients is accounted for by carcinoma of the digestive tract as compared to 23 per cent in Gentiles.

Racial immunity to carcinoma, the ritual dietary laws, poverty, and the more normal blood supply to the generative organs in Jewish women, have been some of the reasons advanced to explain the relative infrequency of carcinoma of the uterus in Jewish women.

These, and many other reasons, however, have been refuted by other authorities; the fact still remains that in spite of the fertility and longevity of Jewish women, carcinoma of the uterus is relatively infrequent among them.

Of 1,237 cases of primary carcinoma of the uterus seen at the Mayo Clinic between 1920 and 1925, inclusive, 1,227 were among Gentiles and 10 were among Jewesses. Ninety-seven per cent of the 1,237 patients were married.

There was a slightly higher birth-rate among Jewish patients, but the difference between the birth-rate among Jews and Gentiles was too small to warrant conclusions.

From data obtained at the Curie Hospital, where two-thirds of the patients were treated for carcinoma by roentgen rays or radium, the incidence of carcinoma was slightly less for the Jewish patients (62 per cent) as compared with carcinoma in the Gentiles (66 per cent).

Carcinoma of the uterus is comparatively infrequent among Jewesses, being about one-fourth as frequent as in the Gentile women (3.9 per cent as compared with 16.5 per cent).

Carcinoma of the breast in the female is common among Jewesses and almost equals the percentage in Gentile women, the incidence being 26.4 per cent and 28.3 per cent, respectively.

Carcinoma of the digestive tract, including the liver and pancreas, was almost twice as frequent in the Jew as in the Gentile, being 30.2 per cent and 17.1 per cent, respectively.

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COMPRESSION OF DUODENUM BY MESENTERY AND THE SUPERIOR MESENTERIC VESSELS—AN UNDERLYING CAUSE OF ACUTE GASTRIC DILATATION

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THE purpose of this paper is to review our present knowledge of a pathological condition fairly common in practice, and serious in its consequences, that frequently escapes recognition; and to direct attention to a study of the mechanics involved, a knowledge of which is necessary before proper measures for the prevention and treatment of the condition can be adopted.

Acute gastric dilatation may be seen accompanying or following any condition in which shock is present. Shock may be produced by operative procedures, or it may be brought about as a result of traumatism. Gastric dilatation is also frequently seen as a complication of a severe infectious disease such as pneumonia.

My attention was called to the condition several years ago by a rather striking case.

Mr. W., white male, aged 48 years, entered the hospital because of an injury sustained in an automobile accident a few moments previously. He had been knocked breathless for a time but on entering the hospital was conscious and of normal sensorium.

Examination. The patient was florid, of the sthenic type, inclined to obesity, with temperature normal; pulse and respiration slightly accelerated. He was in considerable shock. Several slight contusions were noted over the body. The head, neck, thorax, abdomen, and genitalia were negative. There were compound fractures of the tibiæ and fibulæ at their middle thirds. Laboratory findings, excepting X-ray, were negative.

Treatment. The patient was placed on a fracture bed, in dorsal decubitus, with the legs supported in box splints. There was no attempt to reduce the fractures at this time because of shock and the general condition.

Subsequent history. The most prominent symptom was vomiting, which came on early and persisted throughout the illness at frequent intervals and in large amounts. The vomitus consisted of a thin greenish fluid of very foul odor.

Abdominal distention became marked, beginning over the epigastrium and later occupying the entire abdomen. The temperature and blood pressure remained low, the pulse rapid and of small volume. The stomach was lavaged at frequent intervals but this gave only temporary relief and the general condition was one of profound exhaustion. Efforts directed toward the relief of distention such as hot stupes, injections of pituitrin, and frequent enemas were unavailing.

It became apparent that we were dealing with intestinal obstruction and accordingly laparotomy was performed. The stomach was found enormously dilated but the small intestine was not distended at this time. We were unable to find an obstruction, but during our search the intestine gradually became distended and we supposed that in some manner we had relieved the source of the trouble. The abdomen was closed and the patient was returned to bed and again placed in dorsal decubitus. The symptoms promptly returned, exhaustion became extreme, and as operation was obviously contra-indicated, a fatal termination seemed inevitable.

A review of the situation brought the realization that the prolonged dorsal position of the patient might, in some manner, be causing a mechanical obstruction of the intestine. In view of this, casts were applied to the legs and the patient turned face downward.

The result was rather astounding in that vomiting ceased immediately and after a short time a large amount of gas and fæcal matter was expelled from the rectum and abdominal distention rapidly diminished. The patient went on to rapid recovery but developed a psychosis which was probably toxic in origin and which lasted several weeks. This condition was evidently one of gastromesenteric ileus or acute gastric dilatation and probably would have subsided in the beginning had we placed the patient face downward and elevated the foot of the bed.

LITERATURE

The following is a résumé of the more important articles that have appeared on this subject. Kellogg and Kellogg (24), in an excellent paper which made its appearance in 1921, cover the bibliography very completely and thoroughly.

The first mention of the subject is contained in an article written in Latin by Boernerus (1) in 1752 and translated by Dr. J. W. Brannan. Yeats (2) in 1820 described toxic symptoms which he attributed to compression of the duodenum by the transverse colon. A

case of congenital contraction of the duodenum was reported by Guyot (3) in 1829. Rokitanski (4) in 1842 pointed out that the intestine at one or more points might be compressed between the abdominal wall and another intestinal loop. In the third edition of this book in 1861 he speaks of compression of the lower portion of the duodenum by the mesentery of the small intestine and the superior mesenteric vessels and nerves contained therein as a cause of acute dilatation of the stomach. Fagge (5) in 1872 described a case of acute dilatation of the stomach which was apparently a case of duodenal obstruction. Glénard (6) in 1889 stated that acute dilatation of the stomach was brought about by atony and sinking of the duodenum, causing a narrowing of the duodenojejunal flexure which made it difficult for the stomach to empty. He described a physiological closure of the duodenum by the mesentery and superior mesenteric vessels, the function of which was to retain chyme for a longer period in the duodenum.

Albrecht (7) in 1899 noted a flattening of the duodenum between the superior mesenteric artery and the spine. By attaching weights to the mesentery, he noted that considerable pressure was necessary to force water beyond this constricted area.

Robinson (8) in 1900 wrote the most comprehensive paper on the subject to date. He reported cases of dilatation of the stomach which were due to compression of the duodenum by the superior mesenteric vessels.

Mueller (9) in 1900 considered acute dilatation the result of a horizontal position on the back. He thought that pre-operative purgation caused a collapse of the intestine and because of this a tendency for it to sink into the pelvis.

Zade (10) in 1905, in a discussion of post-operative ileus said that dilatation of the stomach was the most important factor in bringing about compression of the duodenum.

Conner (11) in 1906 demonstrated on the cadaver that traction on the mesentery might obstruct the duodenum. He believed the mesentery must be long enough to allow the small intestine to rest on the pelvic floor.

Finney (12) also wrote on the subject in 1906 and previously in 1902. He was not certain but that gastromesenteric ileus and acute dilatation might be one and the same thing. He stated, however, that the characteristic symptom of each is dilatation of the stomach and that the findings at autopsy are quite constant, namely: dilatation of the stomach and of the duodenum up to the point where it is crossed by the superior mesenteric vessels. The intestines as a rule are collapsed and lying in the pelvis.

E. A. Codman (13) in 1908 described pressure on the transverse portion of the duodenum and thought it might have a bearing on the etiology of such conditions as gastric and duodenal ulcer and gall-bladder disease. Codman's paper is concerned principally with the chronic phase of the condition.

Laffer (14) in 1908 reviewed acute dilatation of the stomach and arteriomesenteric ileus. Bloodgood (16) in 1912 reported cases of duodenal obstruction cured by resection of the cæcum and ascending colon. Other writers on the subject were Spence and Graham (19), Melchior (22), Harris (20), Benjamin (21) and Lane (15). The important paper of the Kelloggs (24) has already been referred to. These authors report 41 cases in which they have performed duodenojejunostomy for relief of duodenal obstruction. Their studies are concerned chiefly with the chronic phase of the subject.

A paper by Wilkie (25) in 1922 stressed the importance of prompt measures and directed attention to postural treatment combined with gastric lavage. McKenty (27), 1924, reported 26 cases with some degree of obstruction of the duodenum from the root of the mesentery.

The last edition of Bickham's Surgery (28) states: Acute dilatation of the stomach is an acute gastric paresis, the exact nature of the condition not known. It is largely held that gastric paresis follows mechanical occlusion, near the pyloric orifice, generally resulting from overlying mesenteric pressure or from duodenal kinking."

Miller and Brown (29) in 1925 conservatively state: "The embryological development of the retroperitoneal segment of the

duodenum brings into relation structures which might cause narrowing of the lumen of the duodenum."

ANATOMY

The duodenum in man is peculiarly situated, in that it is almost entirely retroperitoneal, and is firmly fixed by this peritoneal relationship. This fixed position is further strengthened by the suspensory ligament of Treitz (musculus suspensorius duodeni), a musculofibrous band extending from the lumbar part of the diaphragm to be inserted into the terminal part of the duodenum and into the mesentery beyond. In its course it passes to the left of the cœliac artery and behind the pancreas. The C-shaped concavity of the duodenum is occupied by the head of the pancreas with its uncinate process.

The superior mesenteric artery springs from the aorta and proceeds vertically downward, passing through between the head of the pancreas and its uncinate process to emerge from beneath the transverse mesocolon, after which it crosses anteriorly the transverse portion of the duodenum and enters between the layers of the mesentery. The vein occupies a position immediately to the right of the artery, and joins the splenic vein behind the pancreas to form the portal vein.

The lymphatic channels follow the blood vessels in the mesentery, to end in nodes both ventral and dorsal to the pancreas. Those posterior follow the pancreaticoduodenal artery to the hepatic chain, and those anterior follow the superior mesenteric artery to the mesenteric nodes. There is an anastomosis between the lymphatics of the pylorus, duodenum, pancreas and the chain along the common duct. The nerve supply of the small intestine is from the sympathetic system, through the superior mesenteric ganglion, which is situated dorsal to the superior mesenteric artery. It also receives fibers from the right vagus. The nerves follow the blood vessels and ultimately end in the plexuses of Auerbach and Meissner in the intestinal wall.

Obviously the relations of the root of the mesentery and mesenteric vessels predispose the duodenum to danger from compression. The small intestine hangs suspended from a vertical posterior abdominal wall by the mesentery, and must depend for further support upon the anterior abdominal wall, and upon the pelvic floor, which does not seem adapted to this purpose. This arrangement results in a riding over by the root of the mesentery and a compression from the weight of the intestines of the firmly fixed transverse portion of the duodenum. Furthermore, any considerable pressure at this point would interfere with the circulation, innervation, and the lymphatic drainage of the small intestine since these are all intimately associated in the mesentery at this point. Abnormalities such as peritoneal folds, bands, scoliosis, lordosis, and marked visceroptosis might further add to this disadvantage.

In the dog, pig, and probably in other quadrupedal mammals the relations of the peritoneum to the duodenum differ from those in man just reviewed. The duodenum is a free peritoneal loop in the abdominal cavity and is not compressed by the mesentery or the superior mesenteric vessels. The intestines are supported by a mesentery and, in addition, by a strong horizontal abdominal wall apparently adapted to the function of supporting their weight. When the animal lies down after a hearty meal the weight of the intestines is further supported by the ground. In the quadrupeds there is a tendency for displacement of the intestines toward the diaphragm, but in man's upright position this displacement is toward the pelvis.

The effects of upright posture of man have been cited and discussed by many writers from both theoretical and practical standpoints. Keith (26) 1923 states that anatomists no longer regard the postural adaptations of the human body as a transformation peculiar to man, as did Darwin and Lamarck, but rather as the culmination of a series of evolutionary changes.

SYMPTOMS

The symptoms and clinical manifestations of acute gastric dilatation are quite constant. They come on rapidly as might be expected from the pathology. The most prominent symptom is vomiting, which persists through-

out the illness. It comes on early, occurs frequently, and the amounts vomited are at times very large. The vomitus is thin, greenish, and contains bile. Later it becomes dark and of foul odor but not fæcal in character.

Abdominal distention appears early, rapidly becomes marked, and finally extreme. At first, distention is over the upper abdomen; later it becomes general. Tenderness and discomfort rather than acute pain is the rule; usually, marked rigidity is absent.

The temperature remains low, often subnormal, the blood pressure likewise remaining low. At times there is a slight diarrhœa but more often there is no passage of gas or fæces. There is great thirst and scanty urine, because of no fluid entering the intestine. Prostration is marked; exhaustion comes on early. If the symptoms are not relieved the case terminates fatally within a few hours.

The above picture is one in which there is probably complete obstruction. There are many cases of moderate vomiting and distention which clear up under proper medical measures. These are cases in which the duodenum regains its normal tone in time to prevent complete occlusion of its lumen and the vicious circle described below.

MECHANICS

Acute gastric dilatation probably never occurs unless it is first preceded by intestinal paresis or atony. This may be brought on by surgical shock, traumatic shock, or shock from any cause. It may also accompany grave conditions such as typhoid or pneumonia. It is probable that in all of these conditions the pathology is the same, namely, interference with the nervous mechanism of the gastro-intestinal canal.

Most patients as a pre-operative measure receive drastic purges, the effect of which is to leave the empty intestine in a collapsed state. With the patient lying face upward in bed this condition favors prolapse of the intestine backward into the pelvis. With an atonic duodenum lying between the mesentery and the superior mesenteric vessels in front and the resisting lumbar spine behind, considerable pressure is brought to bear upon this part of the duodenum and thus a tendency to cause closure of its lumen is developed. Constriction of the lumen of the duodenum will react upon the lumen of the stomach and compression of the duodenal wall will react upon its nerve and blood supply. Likewise, compression of the superior mesenteric vessels and nerve plexus will react upon the entire small intestine, causing a disturbance of both circulation and innervation.

With the consequent dilatation of the stomach and its extension downward between the anterior abdominal wall in front and a rigid lumbar spine behind, these structures become further compressed, and the result is a vicious circle. The enormous quantities of fluid usually present probably have as their sources the liver, pancreas, duodenum, and stomach. The large amount of gas in the stomach may be partly swallowed air, but mainly comes about as a result of fermentation.

McLean and Andries (17), and Whipple, Stein, and Bernheim (18) in the study of duodenal toxicity found that after ligation of the jejunum, the animals experimented upon died in a few days. The last named authors have shown that the cause of death is a chemical and not a bacterial one.

TREATMENT

A proper understanding of the mechanics concerned in the production of this disease should aid materially in a more rational régime as regards treatment.

Pre-operative purgation should be avoided because of the greater liability of an empty and collapsed intestine sinking into the pelvis, thus causing a drag on the mesentery and consequent pressure on the duodenum. The large bowel should be emptied by enema because a full cæcum and ascending colon sinking downward and backward will exert traction through its connection with the ileum.

Prolonged anæsthesia and rough handling of the viscera, especially about the upper abdomen, probably aid in producing intestinal paresis.

Dorsal decubitus is probably one of the chief factors in the production of this form of obstruction, and should be avoided whenever practically possible.

Vomiting which persists longer than that which occurs following anæsthesia, should be promptly treated by frequent gastric lavage, ventral decubitus, and elevation of the foot of the bed. Morphine probably does more harm than good as it has a tendency to prevent return of intestinal tone.

Condon (23) 1919 advised intraperitoneal injection of Ringer's solution, in order to float the intestine out of the pelvis and thus relieve drag on the mesentery. With any marked degree of gastric dilatation there would be great danger of the needle entering the stomach. An accident of this kind was reported in the *British Journal of Surgery*, 1921–1922.

This is a disease which requires prompt surgical measures if medical treatment fails. The surgical procedure will depend somewhat on the condition of the patient and upon the findings within the abdomen.

Surgery at the best, however, has shown a very high mortality. Gastro-enterostomy or gastrojejunostomy as well as gastrostomy has given disappointing results.

Anatomically and physiologically, duodenojejunostomy would appear to be the operation of choice. This procedure consists simply in anastomosing the jejunum to the third portion of the duodenum proximal to the mesentery and superior mesenteric vessels. This anastomosis between the jejunum and duodenum will result in a free passage for gastric and duodenal contents into the intestine.

It is possible that acute gastric dilatation develops only in those individuals who are predisposed to it because of a previous chronic mesenteric compression of the duodenum. If this be true, then permanent relief would depend upon the latter operation. However, here as in any other surgical conditions, the operation should be the simplest procedure consistent with circumstances.

The technique of duodenojejunostomy has been described and illustrated in the paper by the Kelloggs, 1921.

CONCLUSIONS

The experience of a number of those who have dealt with acute gastric dilatation in practice or by experimentation, as well as that of the author, leads to the following conclusions:

1. Acute dilatation of the stomach comes about as the result of compression of the third portion of the duodenum by the mesentery and the superior mesenteric vessels.
2. It never occurs unless there is first present atony of the duodenum.
3. It occurs in its milder form quite frequently and usually goes unrecognized.
4. A knowledge of the mechanics involved will aid in an earlier recognition of the condition and therefore a more rational régime as regards its prevention and treatment.
5. Any patient who has been subjected to shock should not be allowed to remain face upward in bed for any considerable length of time.
6. Pre-operative purgation and post-operative administration of morphine are to be avoided as much as possible.
7. If surgical measures become necessary duodenojejunostomy is anatomically and physiologically the operation of choice.

I wish to thank Dr. Robert Terry, Professor of Anatomy of the Washington University School of Medicine, for his kind interest and many helpful suggestions during the course of this study.

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BIOLOGICAL PRINCIPLES IN THE TREATMENT OF UTERINE MYOMA[1]

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UTERINE myomata are a frequent cause of disease in women. It is estimated that they constitute from 4 to 10 per cent of all gynecological conditions. Surely the absolute figures are higher than this because not every myoma causes symptoms immediately if ever and the growth may therefore be overlooked.

It may seem a paradox, but nothing has set back the scientific investigation of uterine myoma and its correct treatment so much as the fact that up to the present time morbid anatomy has occupied so prominent a place in the study of the condition and secondly, the fact that X-ray therapy is so extensively used in its treatment. Pathological anatomy did not permit us to abandon the idea that a myoma is a local disease of the uterus, and X-ray therapy, through its often uncritical application and the prejudiced view of the surgeons has been a great obstacle in that the proper treatment has not always been chosen for the individual case.

This may explain the fact that at the present time no reliable data concerning the origin and correlations of uterine myoma are available. However, one thing may be safely stated: this tumor formation is the expression of a certain insufficiency of the body with a simultaneous local predisposition or alteration. Constitution and heredity are undoubtedly etiological factors. A definite influence must be ascribed to the relationship between the ovaries and the uterus, which is much more complicated than is generally assumed. That any such relation is present in myomatous patients was first recognized by Hegar, who observed, after the removal of both ovaries, not only a retardation of the growth but also an involution.

The functional relations between the uterus and ovaries are reciprocal both in health and in disease. This fact is not yet generally recognized. Practically this means that a perverted function of the ovaries will result in a disturbance of uterine function, which is clinically most obvious in menstruation, a more or less pronounced alteration in the cycle of bleeding being present. On the other hand, perversions of uterine function will influence the ovaries, which normally are responsible for a regular undisturbed course of menstruation.

Different causes may be responsible for functional disturbances of the uterus. They are mainly anomalies of development or pathological processes that take place in the uterus.

This apparently complicated interrelation is explained by internal secretion. While this is generally recognized as a part of the function of the ovaries, it is also necessary to regard it as a part of the function of the uterus. One can explain then the symptoms that occur after hysterectomy with preservation of both ovaries—symptoms that are due to lack of ovarian function. The degree of ovarian function is highly dependent on the presence of the functionating uterus. This mutual relation also explains why the removal of both ovaries results in an atrophy of the uterus. In order to maintain a normal interrelation, both parts of the chain must function normally.

The ovaries of myomatous patients often show abnormalities. They are enlarged, œdematous and have a slightly yellow tinge, and besides they contain a more or less definite number of follicular cysts. They are designated as myoma-ovaries. The explanation of these findings is not quite clear. One can assume that this change in the ovaries is the result of the myoma formation, but the opposite is also possible; namely, the ovarian changes can be regarded as an etiological factor in the production of myomata. Furthermore myomata are sometimes observed in patients in whom the ovaries show no involvement in either an anatomical or functional

[1]Translated by G. de Takats, M.D.

respect. To this group belong the myomata that show first clinical symptoms after the cessation of ovarian function or those myomata which are not inhibited in their growth by repression of ovarian activity.

Usually myomata develop in the corpus uteri, more rarely—in about 5 per cent of the cases—in the cervix. Myomata of the uterine body have always been classified as submucous, intramural, and subserous. As a matter of fact, most of the myomata develop in the first phase within the muscle substance; that is, they are intramural, and only later do they show a tendency to spread toward the inner or outer surface of the uterus or remain intramural. Secondary changes that may take place in the myomata and their symptoms cannot be discussed here.

The cardinal symptom of submucous myomata is bleeding, which appears at first only in the form of hypermenorrhœa, later as a polymenorrhœa. This symptom is not so evident in intramural myomata and is hardly noticeable in subserous cases. The increased volume of menstrual bleeding in submucous myomata can be explained on a gross anatomical basis by the increased surface of the uterine cavity or, still more, of the uterine mucosa. It seems natural that the bleeding should be more intense if the bleeding surface is greater. Yet this alone does not explain the process. The mucosa of the submucous myoma cannot be compared with the surface of a broken down carcinoma, in which the bleeding is due to an arrosion of blood vessels. In myomata the bleeding is of functional origin, the result of an ovarian function. The changes in the uterine mucosa of submucous myomata are characteristic, the most common change being a hyperplasia in which the glands are the chief participants. The glands increase in number and show cystic dilatation. The microscopic examination of the uterine mucosa often reveals pictures corresponding to the premenstrual, menstrual, and interval periods simultaneously. (Adler and Hietschmann.)

The demarcation of the mucosa from the uterine musculature is not very sharp. In certain places the glands penetrate deeper into the substance of the uterus (adenomyositis mucosæ).

Not so rarely the glands penetrate into the submucous myoma itself so that even in a spherical-myoma (Kugelmyom) the picture is the same as that found in adenomyoma. If the massive uterine mucosa is compared with the uterine musculature, one can observe, with more or less regularity, a hyperplasia of the uterine musculature too. Experience with surgical material shows that when the myoma (or the myoma complex) has been eliminated, an involution of both musculature and mucosa takes place. This fact has been noted at pelvic examinations also.

At secondary operations for other conditions, previously characteristic myomatous ovaries have been found normal in size and picture. This is clinically manifested by the return of the normal process of ovulation, which in turn is due to the normal menstrual periods. From these observations, I would conclude that the causative agent of myoma is a stimulus of uterine origin that involves the ovaries secondarily.

In interstitial myomata, especially of the multiple type, the analysis of the pathological processes and of reciprocal functional relations cannot always be clearly established. But even here there has been ample evidence that muscular hypertrophy and hyperplasia of the mucous membrane go hand in hand.

In some myomata of intramural development the uterine mucosa does not show the changes described above. This is true even though the bleeding may dominate the clinical picture. Instead of hyperplasia, an atrophy of the mucosa is found, so that at curettage very little material is removed. However the uterine mucosa often penetrates the musculature, in which event the bleeding may be equally well explained by the theory that secondary functional disturbances of the ovaries have taken place. Analogous observations can be made in the bleeding noted in young girls in the stage of sexual development.

In subserous myomata the involvement of mucosa and musculature, as pointed out before, is quite in the background or may be entirely absent.

These anatomical and clinical facts explain to a certain degree the therapeutic success that follows when the pathological processes of

the uterus cause a functional stimulus of the ovaries. The stimulus is the cause of bleeding; therefore the elimination of the hyperactivity will stop the hæmorrhage.

In such submucous pedunculated myomata (polyp formation), more or less extensive and quite irregular hæmorrhages are present. Here an additional cause of bleeding must be considered. This bleeding is analogous to that observed in our obstetrical experience. The retention of placental remnants that cause uterine contractions easily explains bleeding. A submucous myoma with a tendency to form polyps acts as a foreign body which the uterus tries to eliminate. As a result disturbances in the contraction and also in the circulation of the uterus will take place. The bleeding is of local origin and will stop after the removal of the cause.

The functional disturbances, which vary according to the site of the myoma, are not limited to the ovaries alone. In cases of longer duration further internal secretory disturbances follow. Consequently an intoxication manifests itself especially in the circulatory organs, the heart and blood vessels. This readily explains the pathological changes in the blood and heart, and the tendency to thrombosis and embolism. In pronounced, neglected cases the "facies myomatosa" is a characteristic expression of a generalized disease originating in the uterine myoma.

Figure 1 shows the picture of a typical facies myomatosa.

Figure 2 reproduces the picture of the same patient 7 weeks after the resection of the myoma. The facial expression is quite different.

The above mentioned theory explains the symptoms which follow castration resulting from radical myoma operations and X-ray therapy; and also the fact, that in certain myomata with hyperplasia of musculature and mucosa, the menstruation may be prolonged for an additional score of years.

The genital function of woman begins with puberty and ends with the climacteric. The processes that are active in the female organism in these two periods are diametrically opposed to each other and yet follow the same object, namely the adaptation of the body to the beginning and end of genital function. We know very little as to what causes the ripening of the follicle; important however is the recognition that the normal process of ovulation is dependent on a satisfactory development and corresponding function of the uterus. A part of the menstrual disturbance during puberty has surely its explanation in a hypofunction of the uterus. This will also become manifest if a primary hyperfunction of the ovary is present. Herein lies the foundation for ovarian resections in certain menstrual disturbances.[1]

Of course the whole problem is not settled by this one theory. Other factors in the relationship of the genital function to the entire internal secretory apparatus have to be considered. The entire constitution is unquestionably decidedly influenced. Could we understand all the factors, we would understand why in certain cases puberty drags along for several years with more or less local and general disturbance while in other cases this complicated process is completed without any friction in a short time.

At the time of the climacteric the course of events is reversed, as here the extinction of genital function takes place. Just as we have no knowledge of the cause of the ripening in the follicle, we are not as yet advised why the follicle gives up its function. It would seem logical to assume that the reserve of follicles has been used up during the several decades of genital activity. This may be true in cases in which the original anlage of follicles has been more or less scanty. In several cases of early climacterium I found a total absence of follicles in microscopic sections of the ovaries. The same status was found in women who had often many years before had an extensive reduction of ovarian tissue and who had had for a more or less extensive period after this operation a normal menstruation. In these cases also the follicle reserves have been used up. Normally, however, the number of follicles is sufficient for a whole lifetime up to the highest age provided that all follicles ripen. Why this is not the case is a question. In some cases disturbances of development may be responsible, but usually it is due to the lack of inner stimulus. Numerous clinical observations support this theory and it is easy

[1] Zentralbl. f. Geburtsh. u. Gynaek., 14, 1926.

to furnish anatomical proof. One has only to examine the ovaries of pregnant women or of women who have previously had the uterus removed. Furthermore at the climacteric a diminution in the number of follicles is demonstrable. It should be emphasized that one can find follicles a long time after menstruation has stopped. My investigations permit me to assume that the total disappearance of follicles sets in only when the senile involution of the uterus takes place. This would also explain to a certain degree why some ovarian tumors that occur at this period cause uterine bleeding. Stimulated by the growth a belated ovulation ensues, which is naturally possible, only when the ovary still has available follicles for development. The prolonged ovulation which certain myoma patients show has been pointed out before and can be easily explained by the uterine stimulus originating in the myoma and reacting on the process of ovulation.

If internal secretory influences are regarded as responsible for the ripening and atrophy of the follicles, then the differences in the clinical picture of the whole process of retrogression and the time of duration can be understood. All will depend on the reaction of the whole body to the process of reinstatement of the new internal secretory balance. It is evident that here the entire constitution plays an important rôle. Other factors of influence are whether the genital function has ceased suddenly and, especially, whether it has been in a state of increased activity. Normally this involution takes place gradually and therefore the symptoms due to the lack of the organ are not pronounced except when certain complications resulting from the status of the nervous system are present.

After surgical removal of the uterus or ovaries and after castration with the X-ray, the symptoms are much more stormy. It seems from the literature and from our own observation that these symptoms are much more pronounced after X-ray castration than after ovariectomy. This is probably the result of the general damaging influence of the X-rays, because no one can believe today that the effect of these rays is limited to the functional elimination of the ovarian follicles. That beside the local effect at the site of application, a general influence on the whole body is exerted, especially on the internal secretory apparatus is becoming more and more a universal opinion.

The surgical removal of the uterus does not lead to immediate damage to the ovaries, therefore the internal secretory apparatus has time to adjust itself. Yet the symptoms resulting from lack of ovarian function are not avoided. It is known that the age of the patient is important: the earlier the elimination of genital function, the stormier the symptoms. However they do not persist throughout life, probably because of a different interrelation of all organs of internal secretion and because other organs assume the genital function. Diverse variations and combinations are possible, the details of which we know little about. It is known for instance that a congenital defect of the genital organs may exist with an otherwise perfectly normal female habitus and female reaction, and with no symptoms due to a loss of function. It is equally well known that the appearance of such symptoms after a double ovariectomy may be averted by an ovarian transplant, but only when a uterus with secretory function is present.

Hand in hand with the study of the interrelation between uterus and ovaries and their rôle in the internal secretory apparatus, the question arises as to the source of myoma formation. We do not believe that this is an entirely local process. Constitution, nutrition, and the different requirements of daily life are important. Nobody who studies the question of myoma will deny the importance of a sexual component. It was rightly pointed out by Kehrer that abnormal sexual intercourse such as coitus interruptus may be a frequent exciting factor of myoma. Psychosexual reasons should be given a liberal consideration according to personal observations. Olshausen pointed out years ago that chronic hyperæmic conditions of the uterus may constitute a premyomatous stage and have a definite influence.

In the treatment of myomata the considerations I have mentioned may be valuable in reducing the frequency and the extent of development. All known factors in the causa-

Fig. 1. Fig. 2.

Fig. 1. One day before the operation.
Fig. 2. Three months after the operation.

Fig. 3. Mrs. O. St. Posterior wall of the uterus with submucous myoma, obtained by resection. Plastic reconstruction of the uterine cavity was done later.

tion of myoma should be eliminated. The regulation of metabolism plays an important part as it is based in a large measure on internal secretion. Circulatory disturbances of the pelvis of whatever origin must be eliminated. Before the advent of the modern radical therapy of myomata, mud baths were used extensively. They have now been discarded because our decidedly anatomical conception of uterine myomata could not expect any success from such a treatment. This is naturally true, but it does not alter the favorable results that were previously obtained and that can also be obtained now, if the question of myoma is looked at from a broader angle. Uterine myoma does not necessarily require a radical treatment such as hysterectomy or castration with the X-ray; if an early expert treatment can be instituted, much more conservative methods can be applied. Metabolic and circulatory disturbances can be relieved by adequate measures, such as mineral water cures and baths. A valuable clinical hint is the behavior of menstruation. Every hypermenorrhœa and polymenorrhœa with or without dysmenorrhœa must be more carefully analyzed. It must be determined whether the perversion of genital function is of uterine or ovarian origin because a primary uterine disturbance releases an ovarian reaction and vice versa primary ovarian damage causes uterine disturbances. In the analysis of these complicated relations, the curettage will be a great help. A careful study of the uterine mucosa may give us a deep insight into the functional interrelations between ovary and uterus. The curettage will often start the process of healing in the clinical sense although naturally this will not mean a complete retrogression of symptoms. In other cases a partial reduction of ovarian tissue may be considered, namely, in cases of ovarian hyperfunction. The radical methods mentioned above should be considered only as a last resort. They should be applied only when the genital function is about to be extinguished or when the functional damage caused by the myoma has resulted in a generalized disease process which cannot be relieved otherwise. In all other cases, the object of modern myoma therapy should be to remove the growth only and leave the genital function intact. This is successful more often than one would think.

In recognition of the importance of preserving the uterus and in an exaggerated endeavor to preserve the possibility of childbearing, some surgeons of earlier days (Martin, Olshausen, and others) advocated the enucleation of myomata. However this procedure was dangerous. It was an incorrect anatomical procedure that is still performed in our days by surgeons of reputation, namely the splitting of the capsule of the myoma and the peeling out of the growth, leaving the capsule. I pointed out several years ago that this procedure is anatomically incorrect and advised instead the excision of the myoma

Fig. 4. Mrs. O. St. Uterography of the uterine cavity 3½ months after the operation.

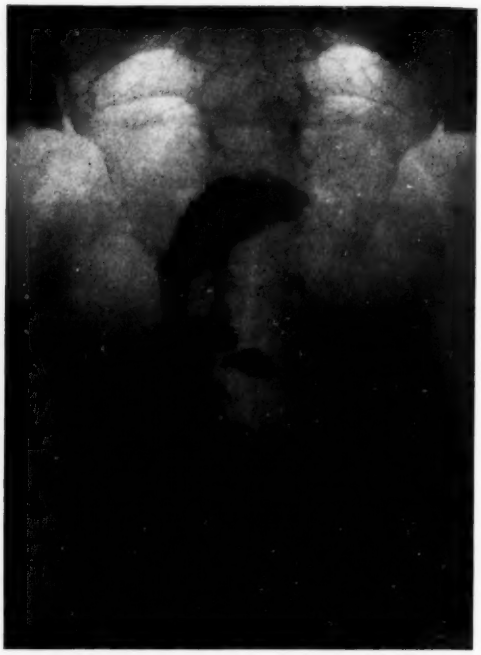

Fig. 5. Uterine cavity with myomata located chiefly in the submucosa.

together with its capsule. Quite recently Fraenkel accepted this view on the basis of anatomical studies. The advantage of my procedure lies in the more favorable wound conditions and consequently better chances of healing. This technique can be adapted to the individual case, and also provides that at the end of the operation only one wound remains to be taken care of and not several as is the case after enucleations of isolated myoma. When the myoma is excised, the operation may have to be extended to include resection of the uterus but always with the object of preserving menstruation. It had been the object of the enucleation to restore the child-bearing possibilities. However this consideration is only secondary in the cases of myomatous patients of more or less advanced age; really the only practical consideration is preservation of the internal secretory function. I have had the experience that myomatous uteri are excellent subjects for plastic operations. After performing conservative myoma operations for many years, I have come to the conclusion that one can resect any part of the diseased uterus without any risk. Large myomata that distort the uterine cavity to a great extent can be excised with good results even when the whole posterior or anterior surface of the uterus or a lateral ridge must be removed. I have always found it possible to cover the defect with the remaining part of the uterus and the functional activity in regard to menstruation could be restored.

The diagnosis of uterine myomata is generally so well defined that mistakes are comparatively seldom encountered. In young women one may be now and then confronted with difficulties for reasons easily understood. We found in all these cases an excellent help in the application of uterography. This method permits us a clear insight into the form of the uterine cavity that is more or less distorted in cases of myoma. After long preliminary experiments, the following procedure has been adopted:

After a thorough evacuation of the bowels and the bladder the patient is brought in a half-Trendelenburg position. Slowly and with

slight pressure 2 to 3 cubic centimeters of a 40 per cent iodipin solution, which has been warmed to body temperature, are injected into the uterus through a catheter used for patency test. The cervical orifice is then compressed with Volsellum forceps and an X-ray picture is made. This gives an astonishingly clear picture of the topography of the uterine cavity, of the length and patency of the tubes, and important hints as to the presence of complicating adnexal pathological conditions.

Because a large number of our operations have been limited to the removal of the diseased part of the uterus, the formation of a new uterine cavity has been necessary. It was highly interesting to see the end-result of these operations. This has been made possible now by uterography.

Figure 3 shows the result of an operation in which a large myoma on the posterior wall of the uterus was removed in one mass with the uterine wall.

Figure 4 shows the form of the new uterine cavity 3½ months after the operation.

Figure 5 shows a uterine cavity distorted by submucous myomata.

Uterography with the injection of iodipin is a harmless procedure, as very extensive personal experience and numerous control examinations have proved.

CLINICAL SURGERY

FROM THE BESLEY-OSGOOD CLINIC

OPERATION FOR TRAUMATIC RUPTURE OF URETHRA IN THE MALE

By FREDERIC A. BESLEY, M.D., F.A.C.S., Waukegan, Illinois

REFRESHING the memory as to the anatomy of the urethra, one will note that the membranous portion lies just anterior to the prostate, is about one half of an inch long, and is surrounded by a small amount of muscular fiber. It is continuous with the cavernous urethra as it passes between the bulbs. This membranous portion of the urethra is the part usually torn or lacerated by injury, although the cavernous portion is frequently involved.

These injuries are usually inflicted when the individual falls astride a sharp edge striking the perineum. The diagnosis is usually made without difficulty; pain, inability to pass urine, and bleeding from the meatus being the cardinal symptoms and signs. The inability to pass a catheter into the bladder is usually sufficient to confirm the diagnosis.

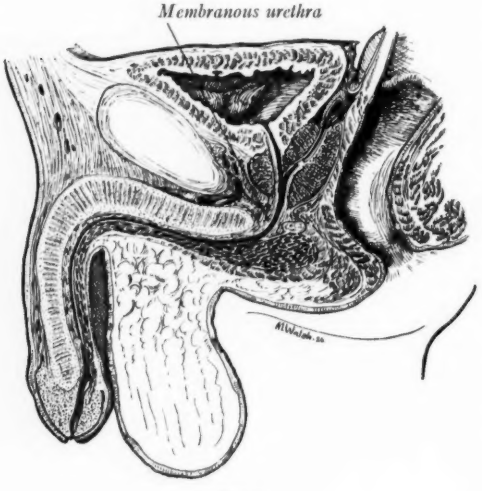

Fig. 1.

OPERATION

The skin over the perineum is prepared with soap and water without irritating antiseptics. The perineum is infiltrated with 1 per cent novocain, or sacral anæsthesia may be employed. A sound is then passed down to the lacerated portion of the urethra, and a long longitudinal incision is made in the median line of the perineum, passing through skin and fascia until the bare end of the sound is well exposed, and the lacerated urethra is visualized.

After a free incision exposing the torn urethra is made, a large rubber drainage tube is sutured into the wound down to the lacerated urethra. This provides for the escape of urine as the patient voids it. The wound is then loosely packed with gauze, which is removed the following day and no new packing is employed.

The tube is retained for 6 or 7 days or until granulation is well established. After about 10 days the patient will begin to void urine through the anterior urethra in increasing amounts, unless the destruction of tissue has been very extensive.

If for any reason the patient should be unable to void urine through the incision in the perineum, or if there should occur an increasing extravasation, it may become necessary to provide suprapubic drainage, which can be done under local anæsthesia.

Experience has taught that suturing of the torn urethra is not necessary. Unless the operation is done almost immediately, as it should be, there will be some extravasation of urine with subsequent sloughing, and the suturing of such tissue is obviously useless and technically impossible.

The desired accomplishment of the operation in these cases is the establishment of free drainage and provision for the ecape of surine. Practically nothing is gained by suturing the tear in the urethra, for the sutures usually cut out and add to the destruction and loss of tissue, the

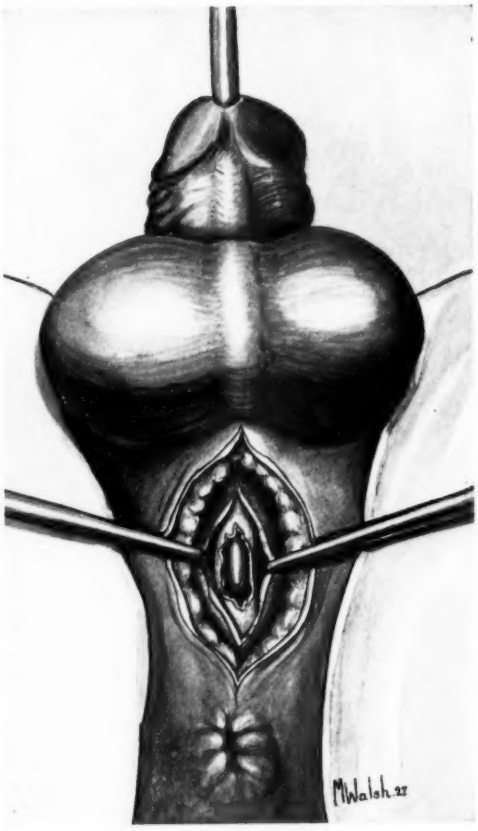

Fig. 2.

vitality of which is materially lowered by the crushing and by the extravasation of urine. Suturing of the tear in the urethra would necessitate a retained catheter or suprapubic drainage.

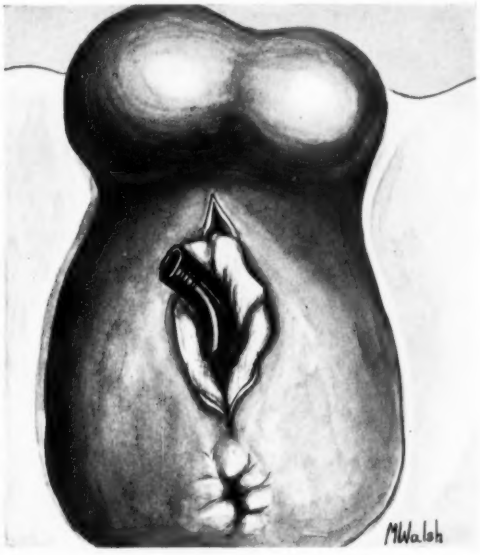

Fig. 3.

A catheter in the urethra, or a drainage tube introduced through the tear and into the bladder always causes more or less necrosis of the mucous membrane by pressure which adds to the tissue destruction. This loss must be ultimately replaced in the healing process by new tissue formation.

It is well understood that the urethral mucous membrane has the intrinsic power of covering large defects by virtue of the prolific hyperplasia of its epithelium.

Rarely will plastic repair of the urethra have to be resorted to.

Six cases have been treated in this manner at the Clinic without complication and with rapid convalescence.

FROM THE SURGICAL DEPARTMENT, UNIVERSITY OF NEBRASKA COLLEGE OF MEDICINE

THE TREATMENT OF ANNULAR GANGRENE OF THE SMALL BOWEL BY INVAGINATION VERSUS RESECTION

By JOHN E. SUMMERS, M.D., F.A.C.S., Omaha, Nebraska

SURGEONS are generally agreed that in a case of gangrenous intestine one of two lines of procedure must be followed, either the gangrenous bowel must be resected or an artificial anus formed. "Whenever possible, i.e., in cases in which the condition of the patient and the experience and help ready to the surgeon's hand admit of his taking this step, the gangrenous intestine should be resected" (Jacobson and Rowlands). In other instances an artificial anus should be formed with the hope that this will prove a life-saving measure, and that at a later operation the continuity of the intestinal canal can be re-established.

Experience has taught me that when the gangrene is limited and annular in type it may be much more safely handled by invagination of the gangrenous bowel that by resection or the making of an artificial anus. Especially can I recommend the procedure in those dangerous cases in which the success of a resection may be in grave doubt and the formation of an artificial anus the only alternative. The technique is applicable also to the treatment of traumatisms of the small intestine from contusions and gunshot wounds, the repair of which, because of their peculiarly destructive, bursting character, if accomplished by suture, may so limit the lumen as to result in dangerous stricture or kinking of the bowel.

Resections of the gangrenous bowel are dangerous because infection may happen at the time of the carrying-out of the technique, or leakage of the line of suture may occur later. Patients suffering from gangrene of the bowel are in a seriously depressed condition and the shock of the surgical operation of resection, even when done under local anæsthesia, adds to the gravity of the situation. After the successful making of an artificial anus, which is usually a safe, simple procedure when done under local anæsthesia, complications not infrequently arise. Not only may serious local infections develop in the sac and its coverings, spreading upward under the peritoneum, but also, particularly in the case of a femoral hernia, septic embolism in the femoro-iliac vein may form, resulting in pulmonary embolism. These patients become very much depleted from the continuous intestinal discharge, more particularly when the opening in the intestine happens to be high above the ileocæcal valve. The mortality is estimated by many authorities as high as 70 to 80 per cent.

A limited gangrene of short duration, accompanied by marked constitutional symptoms, is of graver import than one of an opposite type, that is, one more extensive in the length of bowel involved, and of longer duration of strangulation, but with rather mild constitutional symptoms. In the earlier periods of a strangulated hernia developing gangrene, the passage of microbes through the intestinal walls, and their multiplication in the fluid of the hernial sac, is limited, but as time advances their proliferation increases. If the gangrene has localized within the sac its coverings may become involved by the microbic infection penetrating the walls of the sac, and the contents of the bowel discharge externally—Nature's attempt to cure. The infection most often spreads inward to the peritoneum. In the instances when only a small portion of the bowel is constricted, as at the so-called internal inguinal ring (Richter's hernia), gangrene may form very rapidly, with early infection of the peritoneal cavity, or constitutional symptoms of a very grave character may result from microbic circulatory infection. They are usually not pronounced before 72 hours after the onset of the symptoms of strangulation, but I have operated upon a man with a strangulated hernia, through an old appendectomy wound, 24 hours after the first symptoms. His temperature then was $103^3/_5$ degrees F., and his pulse 130; 15 centimeters of the small bowel was gangrenous.

In order to evaluate the technique advocated as against the customary methods just noted, I must refer to my original communication on the subject published in 1908 (1).

Case 1. A young man was operated upon for a right inguinal hernia which had been strangulated for 4 days. His general condition was so serious that I doubted the propriety of any surgical attempt for his relief. However, the field of operation was prepared and under local anæs-

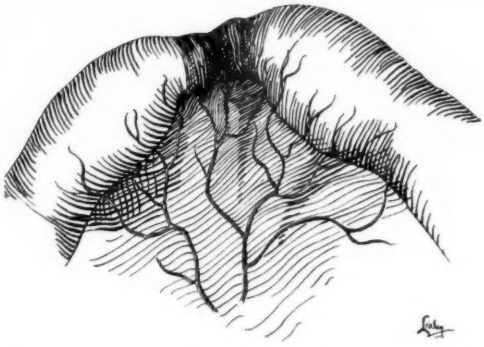

Fig. 1. Limited annular gangrene of the small bowel.

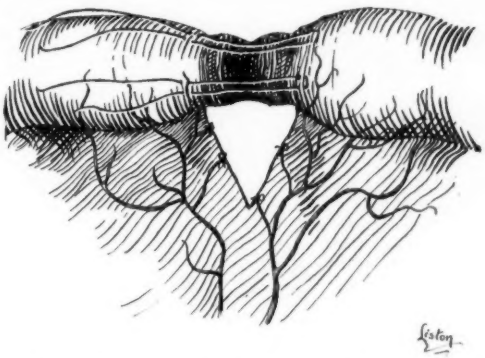

Fig. 2. Mesentery excised; mattress stitches introduced.

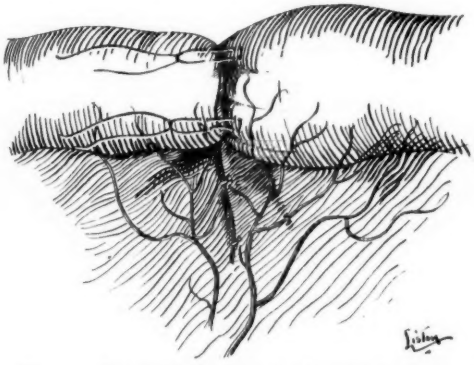

Fig. 3. Intussusception made downward, edges of mesentery approximated; mattress stitches being tied.

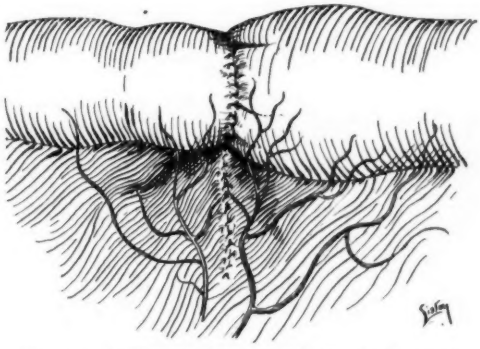

Fig. 4. Intussusception secured by circular suture burying mattress sutures; mesentery sutured.

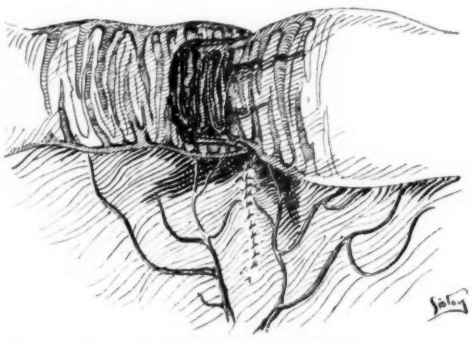

Fig. 5. Cross section of intussusception downward.

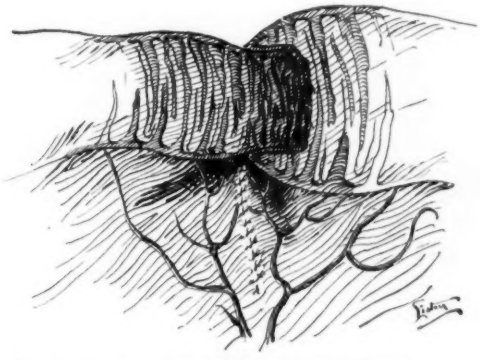

Fig. 6. Cross section of intussusception upward.

thesia, cocaine, the hernial sac was opened. It contained a loop of small intestine, a part of which, 4 centimeters long, was gangrenous, soft, but not very friable. The lumen of the bowel above and below the gangrenous area was about the same, probably because of the two days of stercoraceous vomiting which had preceded the patient's entrance into the hospital. As the man's general condition did not warrant a resection, it occurred to me to make an intussusceptum of the gangrenous intestine, invaginating by manipulation sufficiently far so as to have sound tissues to suture at the neck of the intussusception, using for the purpose a circular, continuous, seromuscular stitch of silk. No attempt was made toward the radical cure of the hernia.

The grave, collapsed condition of the man did not seem to have been added to by the surgical procedure and he gradually reacted to restorative measures. His bowels moved at the end of 24 hours, and he made a good recovery. Six months after the operation he wrote stating that he was in excellent health, but that he still had the hernia.

CASE 2. An elderly man was operated upon under ether anæsthesia for a strangulated, right oblique inguinal hernia which had been present 15 hours. The condition of the bowel was practically the same as that found in Case 1. The gangrenous ring, however, was not quite so extensive. An intussusception was formed after passing four equidistant and seromuscular mattress silk stitches around the circumference of the bowel parallel to its long axis. In making these stitches the needle was entered 1¼ centimeters below the gangrenous ring, and at about the same distance above it, and then back again near the point of starting. As the ends of these stitches were pulled on by an assistant, the invagination was aided by grasping the bowel below the stitches between the index and middle fingers, and pulling upward, while with the thumbs above pressure was made downward, a method similar to that employed in reducing a paraphymosis. Great gentleness was, of course, exercised in making this manipulation. After tying the mattress stitches the line was reinforced by a circular seromuscular silk stitch passed a little higher up, so as to bury the mattress stitches. A Ferguson operation for the radical cure of the hernia was done. The man recovered without complications and was reported well several years later.

The following case will illustrate how the technique advocated can be applied in injuries to the small intestine, in this instance a gunshot wound.

CASE 3. A boy, age 16 years, had been accidentally shot in the abdomen with a 32-caliber pistol. I operated on him 9 hours later. There were 12 perforations of the small bowel, all very easy of repair except one which was so destructive (explosive) in character, that to suture it would practically close the lumen of the bowel. Neither was it possible to trim the edges of the wound so as to form a rhomboid that could be sutured advantageously. It was a resection and nothing else, unless the injured section of the bowel could be invaginated as in Cases 1 and 2. This was done, about 3½ centimeters being invaginated. No complications ensued, and the boy made a good recovery.

A case very similar in character to that just narrated, operated upon November 13, 1926, has an important bearing upon this technique:

CASE 4. A boy 11 years of age was shot in the abdomen, at short range, by a 22-caliber rifle (long cartridge). The bullet injured the small bowel, practically tearing it in two. There was also a perforation about 7 centimeters distal to this; likewise, an extensive wound of the cæcum. I made an invagination of the injured portion of the small intestine, the carrying-out of which was rather difficult because of the fact that the injury was oblique to the long axis of the intestine, and the closure of the perforation distal to this injury had to be done over the intussuscipiens portion of the intussusception. It was easy, by pressure, to force gas along the course of the bowel through the intussusception. The wound in the cæcum was repaired. There had been considerable leakage from it, as well as leakage and hæmorrhage from the wound in the small bowel. A careful toilet of the peritoneum was made and a rubber-dam drain introduced. The boy did well for 48 hours, pulse and temperature being only slightly above normal. He then began to develop symptoms of obstruction, slight epigastric distention and vomiting. There was a copious serous drainage. It was decided to re-open the incision wound and do an anastomosis around the intussusception. When the intussusception was exposed it was found to be in perfect condition. Some gas could be forced through, but the bowel was considerably distended above and it was thought wise to make the anastomosis. This was easily carried out. The boy died 48 hours after the second intervention, with symptoms of general peritonitis. At autopsy it was disclosed that there was no leakage of the intussusception nor of the anastomosis, and that death was due to peritonitis, the result of the original injury.

In similar instances and in instances of threatened gangrene, when one is afraid of the vitality of the gut after releasing the constricting cause, and also when the limit of the suspected area is less than 10 centimeters, the involved gut should be crushed with an angiotribe, thus positively determining its early death, and this crushed portion invaginated, and the intussusception properly sutured. In certain well comprehended instances the suspected gut should be temporarily exteriorized and protected by moist, hot dressings to determine its viability before resort is had to the use of the angiotribe. There would have been practically no obstruction by the intussusceptum in the second case of gunshot wound, had the angiotribe been used. If the extent of gangrene involves more than 5 centimeters of the intestine it is necessary before attempting to make the invagination, to free the mesentery from the bowel and resect it, or not, as indicated.

There are, of course, mechanical contra-indications to the technique offered: When a loop of gangrenous intestine is longer than 10 centimeters it would probably be too difficult to manipulate; or, when the bowel is thick and œdematous immediately above the gangrene, or very much contracted below it, the difficulties of invagination might be insurmountable. This over-distended bowel can be materially reduced by making a small incision into it, aspirating its contents, and closing the small opening by suture. When the upper end is not too much distended, it may be tucked into the lower end with some suitable instrument such as the Allis forceps.

Senn did some experimental work proving that invagination of the intestine could not be made upward and the bowel function. Experimental work on the cadaver has shown that if invagination of the small intestine be made upward for a distance of 10 to 12 centimeters, a valve is formed and fluids cannot be forced from above through the invagination, as when an invagination of the same length is made downward. Nevertheless, there is no question but that if the gut below the gangrene is too small to admit invagination of the œdematous, thickened portion above the gangrene, an invagination may in some instances be made upward and properly sutured so as to hold. The gangrenous intussusception will slough off in 2 or 3 days as it does when the invagination is made downward, and the natural current of the intestinal flow be re-established. I have had occasion to try an upward invagination in only one instance. The technique was not difficult; and the patient, a woman, died, not because of the nature of the technique, but because of the fact that she was operated upon too late.

In a recent experiment upon a large sized dog a section of the small intestine 10 centimeters long was freed from its mesentery and the proximal and distal ends crushed by a powerful angiotribe. This isolated section was invaginated upward and the bowel sutured so as to form an intussusception. The dog died from obstruction of the bowels. Had the portion of bowel used as an intussusceptum been one-third or one-half the length used, and its whole area crushed to bring about early necrosis, it is my belief that the created intussusceptum would have sloughed off and the dog survived. I have suggested this technique (1, 2) in limited ring carcinoma of the large bowel, and I have no doubt of its successful practice.

There is a warning to be observed in the carrying out of the technique advocated or that of resection for gangrene in a case of strangulated hernia. A careful débridement should be made of the sac and any of its coverings which may possibly have become contaminated by the gangrenous process; the constricting ring should be so widely divided that in the return of the intestine into the abdominal cavity there can be no possible disturbance of the line of suture of the invagination or resection.

It has long been the practice to invaginate local areas of pressure necrosis of the intestine and bury them securely by sutures. This should always be done when possible, provided it does not obliterate the lumen of the bowel.

Invagination of a gangrenous loop of bowel when otherwise a resection or the establishment of an artificial anus must have been done, was original with me. I had been led to believe from the best obtainable bibliographical sources that the procedure was new, but I discovered in my own library, after my paper was written in 1908 reporting my first operation in September, 1900, that Guinard (3) had done a like operation in 1895.

It is rather seldom that a typical case is presented in which this technique is indicated, and good judgment is required in the selection of cases. I have done the operation only 7 times (2 deaths), as I have hesitated to do it when the gangrenous loop was more than 5 centimeters in length. I now feel that I have missed several opportunities to make the invagination when the amount of bowel involved was greater than this, and have done resections instead. Guinard reports the successful invagination of 9 centimeters of gangrenous gut. He also reports the successful invagination of two gangrenous rings both situated at the level of the neck of the sac of a strangulated hernia, and separated one from the other by a healthy loop. The patient recovered with perfect restoration of function of the gut.

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TECHNIQUE OF A NEW AND STRICTLY ASEPTIC METHOD OF ENTERO-ANASTOMOSIS

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EVER since the beginning of intestinal surgery, in other words, since Maisonneuve in 1853 thought out the process of gastro-enterostomy, and Woelfler performed the first gastro-enterostomy at the instigation of Nicoladoni, surgeons have been busied in improving the technique of these operations. Thanks to persevering effort we have succeeded in doing away with the dangers of inadequate sutures and of gangrene of the intestinal wall, in short, in reducing to a minimum the cases of postoperative peritonitis, so that today one can vouch, with much security, for the success of an intestinal suture. But when, in the course of a subsequent operation, the surgeon has an opportunity of reviewing his work, is he not always disappointed to find his anastomosis surrounded by countless adhesions matting together intestines, stomach, and mesentery?

What is the cause of this imperfection?

The sole cause is the presence of micro-organisms which, once the mucous membrane is penetrated, are carried by instruments, ligatures, or fingers to the neighboring peritoneum, which is thus infected. The only way to avoid this source of infection in intestinal surgery would seem to be by the anastomosis of closed, as opposed to opened, viscera!

Paradoxical and even technically impossible as this may seem at first, we venture to assert that we have solved the problem by a method of entero-anastomosis which enables one to join two loops of intestine, or a loop of intestine and the stomach, without opening the lumen of either viscera.

The technique of the operation is very simple and its execution rapid; its satisfactory character seemed to us so certain both theoretically and practically that we did not hesitate to employ this new method in a patient on the operating table. The result was excellent. The case was one of a terminolateral anastomosis between ileum and sigmoid, operated on at the Clinique La Prairie at Montreux on September 2, 1924.

Since then we have frequently used the method so as to familiarize ourselves with its technique and to improve the special instruments necessary. Having had no bad result to record, that is, none which could be laid to the new procedure, and having perfected the instruments, we do not wish to postpone longer the publication of the description of the new method which we have made as brief as possible.

TECHNIQUE OF END-TO-END ENTERO-ANASTOMOSIS

Let us take as the simplest example, the restoration of the continuity of the small intestine by means of an end-to-end entero-anastomosis after the resection of a gangrenous loop of ileum in a strangulated hernia.

After detaching the mesentery from the gangrenous part, the healthy bowel on each side is freed from its mesenteric insertion for a length equal to the breadth of the blades of an ordinary intestinal crushing clamp, plus a length of 3 to 4 millimeters for the invagination of the first deep circular suture (Fig. 1).

The two ends of the loop to be resected are seized with the fingers *and placed very exactly side by side, one above the other, in the direction of their length, and held in this position*, their mesenteric insertions in close apposition, by means of triangular fenestrated forceps, in such a way as to permit of no displacement or lateral slipping (Fig. 2).

From this point the operation can be continued in one of three different ways, depending on the type of case, each way being based on the principle of simultaneous clamping.

Group I. This group includes the urgent cases in which it is necessary to do a rapid operation or in cases in which the intestine is small and the wall is very thin and transparent (Figs. 4, 5, and 6). The two loops applied one above the other as indicated *are seized together* transversely or in a slightly oblique direction (to insure a better blood supply) with ordinary pressure forceps such as Kocher's hæmostatic forceps, narrow but powerful, with flat toothless blades. The end of the forceps must seize the edge of intestine which exactly corresponds to the mesenteric attachment. A second pair of forceps or an ordinary clamp is placed parallel to and above the first one, the two loops of gut are divided by the knife or the thermocautery between the two forceps, and the gangrenous loop removed (Fig. 3). The groove between the blades of the forceps which hold the two intestines is disinfected with the

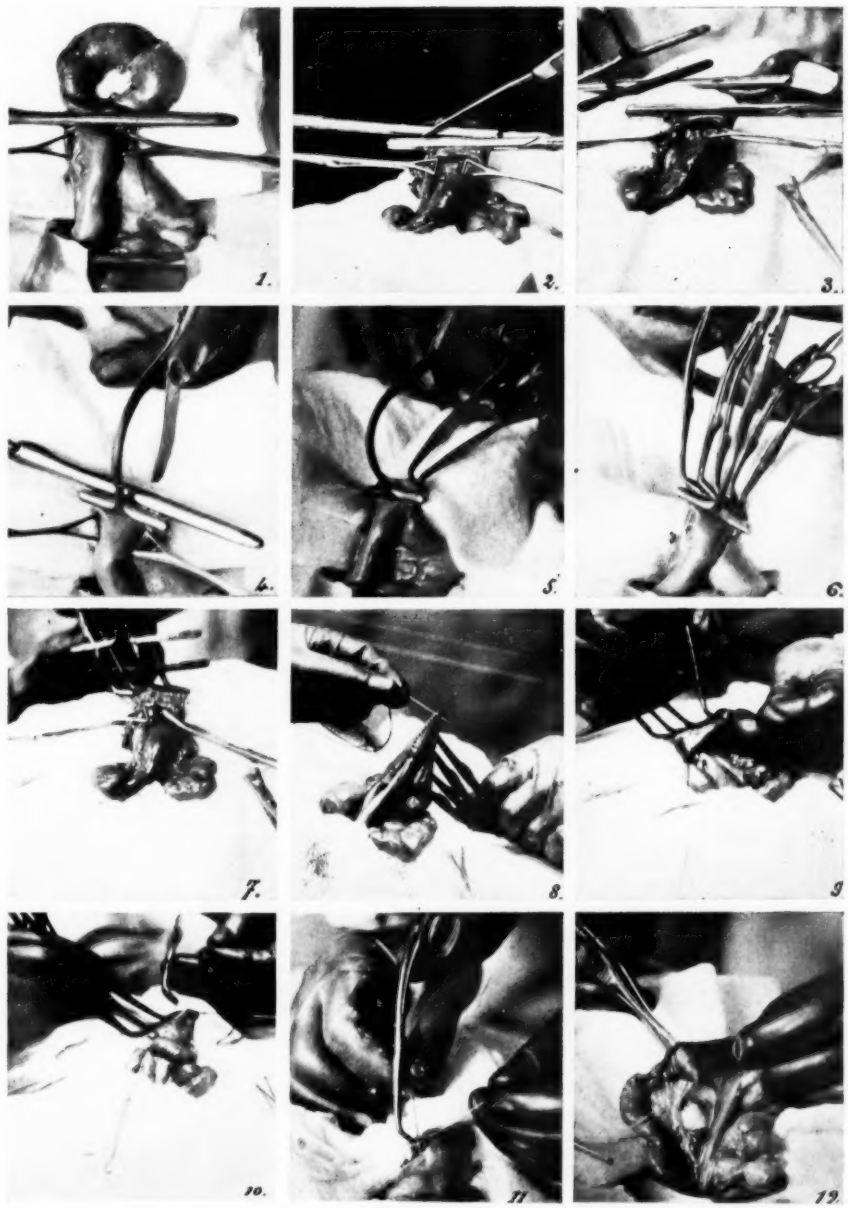


Fig. 1a. End-to-end entero-anastomosis method by simultaneous crushing. Photograph of the various steps in the operation.

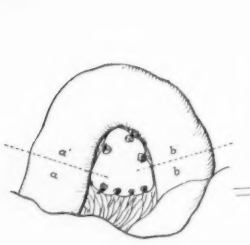


Fig. 1b.

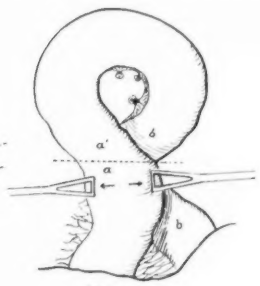


Fig. 2.

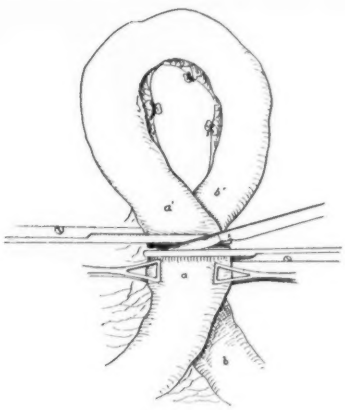
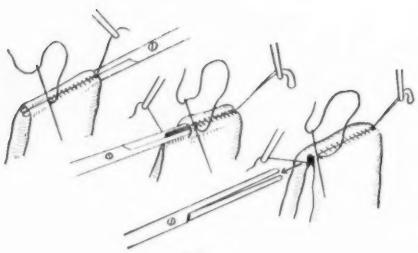


Fig. 3.



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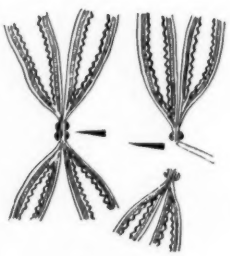

Fig. 5.

Fig. 6.

Fig. 1-b. End-to-end entero-anastomosis. Left, the diseased loop is separated and its diseased mesentery detached from the healthy bowel for a length equal to the breadth of the teeth of the crushing clamp and several millimeters for the sutures.

Fig. 2. Right, the two loops of bowel are placed one against the other, flattened, and held in position by fenestrated triangular forceps.

Fig. 3. End-to-end entero-anastomosis. The two loops are seized together and simultaneously crushed, and the two loops cut through with a bistoury at the same time.

Fig. 4. End-to-end entero-anastomosis in patients with intestine or colon of small caliber (Group I). The two loops have been seized and crushed in toothless pressure forceps. The forceps are turned over and the posterior half of the first circular suture (deep suture) is made from the peripheral to the mesenteric border. The forceps are again turned over and the making of the deep suture continued above them. The forceps are opened and withdrawn backward, and the small opening is closed by two or three isolated stitches which complete the first circular suture.

Fig. 5. End-to-end entero-anastomosis (Group I). The two loops of bowel placed side by side are seized transversely and crushed simultaneously by toothless pressure forceps. A second pair of forceps shuts off the diseased loop; the two loops are cut with a bistoury between the forceps; the diseased loop is removed; and the groove in the forceps is disinfected with the thermocautery.

Fig. 6. End-to-end entero-anastomosis (Group I). Above, left: the two loops of bowel are brought down over the forceps and the first seromuscular suture is made. Above, right: the first seromuscular suture, as it comes back to the starting point, invaginates the forceps. Below, left: the first circular seromuscular suture is finished and the forceps may be opened and withdrawn. The serous folds which have been stuck together are freed. Below, right: the second seromuscular suture is made; it must exactly invaginate the deep suture; and the passage between the two loops is made.

thermocautery or with tincture of iodine. The forceps are then turned over from above downward, this movement separating the two loops of gut from each other and turning them so that they hang down one on each side above the forceps.

With a straight silk-threaded needle the surgeon then makes a fine suture, taking in the peritoneal and a little of the muscular coats of each loop. He begins the suture at the peripheral edge of the intestine where he makes a knot and leaves the end long as a guiding thread. On reaching the

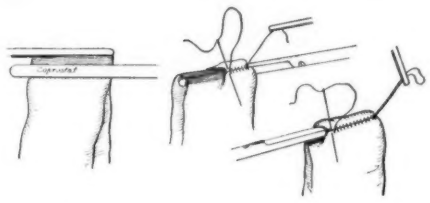

Fig. 7. End-to-end entero-anastomosis (Group II). The two loops of gut simultaneously crushed are temporarily closed by a coprostat. The extreme edge of the crushed zone is seized in a toothless pressure forceps, the coprostat withdrawn, and the forceps are turned over. The posterior half of the first circular suture (deep suture) is made. The forceps are turned into the original position and buried by the anterior half of the deep circular suture.

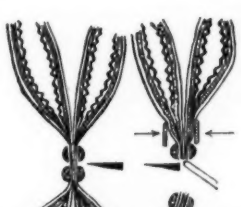

Fig. 8.

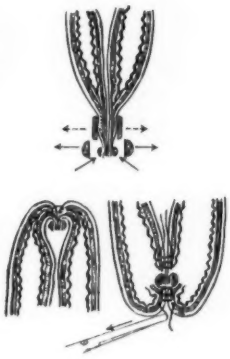

Fig. 9.

Fig. 8. End-to-end entero-anastomosis (Group II). The bistoury is passed between the two closed crushing clamps; the diseased loop removed; and the groove in the clamp disinfected with the thermocautery. The coprostat is about to seize the two loops of bowel.

Fig. 9. End-to-end entero-anastomosis (Group II). Second possibility. Above: the coprostat has seized the two loops of bowel, and the clamp is removed. The crushed edge is seized throughout its length in a clamp with long, flat, narrow blades without teeth. Below, left: the two loops of bowel are brought down to hang on either side of the clamp, and the first seromuscular suture is finished. Below, right: the first suture which has invaginated the clamp is finished so that the clamp may be slightly opened and withdrawn. The second suture is just begun.

mesenteric border he carefully invaginates the smooth end of the forceps, makes a knot and leaves the end (this time double) long as a traction thread. Then the forceps are turned over again to the former position and the suture is continued, completely invaginating the forceps, so that the two peritoneal coats are strongly stitched together. When the beginning of the suture is reached, an assistant picks up and holds taut the two traction threads, and the operator slightly opens the forceps and withdraws them. The small opening left by the forceps is closed by the two last stitches of the suture which is then knotted to the first traction thread.

The operator, taking in his fingers the two walls of the anastomosis, pulls them gently apart, thus freeing in the interior the two double folds of serous coat which had been held together by the blades of the forceps. With a new needleful of silk he now makes a second continuous peritoneal suture, including again part of the muscular coat to strengthen the suture, and taking special care in stitching the region near the mesenteric attachment.

This second suture utilizes the rest of the wall prepared beforehand so that now the two mesenteric attachments are brought together. Finally the edges of the triangular or curved opening in the mesentery, left by the resection of the diseased loop, are brought together by interrupted silk stitches or a fine running suture of silk.

This method of making an end-to-end anastomosis is useful especially for urgent cases in which speed is of the utmost importance, but also when one has to deal with a small intestine the walls of which are very thin and transparent, and therefore easily seized and crushed by ordinary smooth bladed forceps. This is frequently the case with the small intestine of a child.

But the objection may rightly be made that such forceps would be neither long enough nor powerful enough to crush two distended and hypertrophied loops of small intestine or two loops of colon. In such a case one would have recourse to the following plan:

Group II. This group includes the cases in which the caliber of the intestine or of the colon is normal (Figs. 7, 8, and 9).

The two loops placed side by side are clamped simultaneously with an intestinal clamp the blades of which are not too wide and are without teeth at the ends. The diseased loop, closed by a second clamp, is separated with the knife and removed, this procedure being followed by disinfection with the thermocautery or with tincture of iodine.

An ordinary coprostat is then placed immediately below the clamp in which the two loops of intestine are suspended side by side. This coprostat is closed just sufficiently to prevent these loops escaping but so as not to injure the intestinal wall. When it is in position the clamp is removed, so that the crushed border composed of the four folds of serous coat closely applied together is exposed.

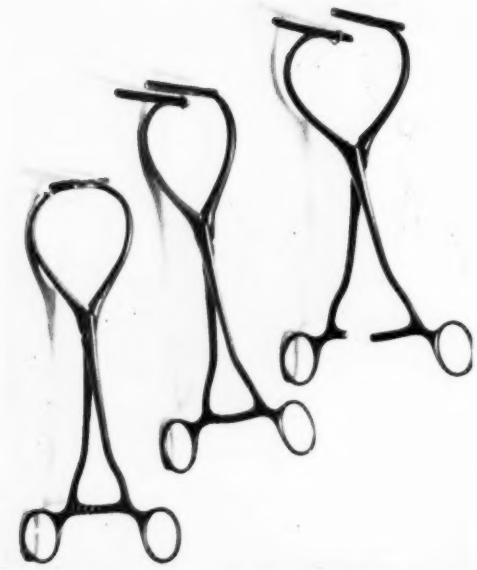

Fig. 10. Coprostatic clamps with blades of varying length. The teeth are ridged longitudinally, and the handles joined obliquely to the teeth, either in the middle or away from it.

Fig. 11. Invaginators. The blades are all identical, the increasing length of the handles being the only difference. The handles are curved so as not to get in the way of the hand which is making the suture.

The extreme edge of this crushed border is immediately seized in its whole length by a pair of forceps with flat toothless blades the points of which must not extend beyond the mesenteric attachment of the crushed border. The coprostat is then removed and the two continuous sutures made in the same way as before, the only difference being that the needle will always enter and leave the serous covering of the healthy bowel wall just at the base of the crushed zone. The invagination of the forceps will be easier because there will be only the very thin crushed folds of serous covering to be invaginated by the first circular suture.

This procedure will be suitable in the majority of cases of resection of the small intestine when haste is not of vital importance. If, on the other hand, one has to deal with a large fleshy colon, or if, in the course of a right-sided hemicolectomy for ileocæcal carcinoma, for example, one has to make an end-to-end anastomosis of ileum and transverse colon, the above method might be unsatisfactory. The forceps might slip or be difficult to withdraw. In this case the procedure is as follows:

Group III. In this group are the cases in which the gut is of large or unequal caliber. Two new instruments are necessary for the performance of this variation of the operation: a coprostat, which, however, is not indispensable, and an invaginator. These instruments are not expensive and can easily be made by any good surgical instrument maker.[1]

Figure 10 shows the coprostatic clamp of which it is customary to have 2 or 3 with blades of varying length. The blades have a transverse ribbing to prevent slipping.

Figure 11 shows a number of special forceps for invagination. They vary only in the length of their handles, the blades being identical in all. Six to eight of these invaginators are quite enough for an ordinary anastomosis.

As mentioned previously the two loops of intestine are applied one upon the other and kept well exposed while a powerful crushing instrument crushes them simultaneously in a transverse direction, slowly and completely. The diseased loop, closed by a second clamp, is separated with the thermocautery and removed. The groove in the clamp is cleaned with a swab of gauze and either the thermocautery or tincture of iodine (Fig. 12). This crushing clamp now holds in its blades at the

[1] Ours were supplied with the greatest courtesy by M. Bocksberger of Lausanne.

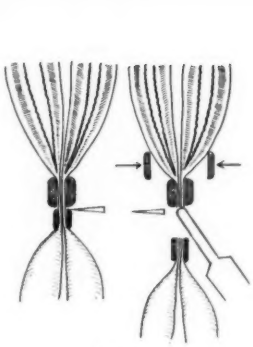

Fig. 12.

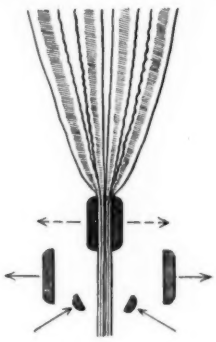

Fig. 13.

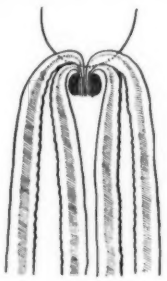

Fig. 14.

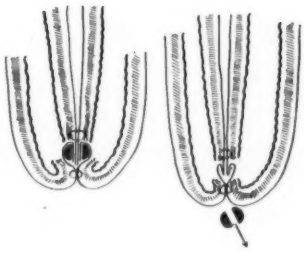

Fig. 15.

Fig. 12. End-to-end entero-anastomosis (Group II). The two loops of bowel placed side by side are crushed simultaneously. A second crushing clamp shuts off the diseased loop. The bistoury passed between the two crushing clamps cuts the two loops and the diseased loop after being separated with the thermocautery is removed. The groove in the clamp is disinfected with the thermocautery. The coprostat is about to seize the two loops so that the clamp may be removed.

Fig. 13. End-to-end entero-anastomosis (Group III). The coprostat is in place and the clamp has been removed. As soon as the invaginators have seized the crushed edge, the coprostat will in turn be removed.

Fig. 14. End-to-end entero-anastomosis. Third possibility. The two loops of bowel are turned down to hang on either side of the invaginators, and the first seromuscular suture is commenced.

Fig. 15. End-to-end entero-anastomosis (Group III). On one side the first seromuscular suture is finished. The invaginators are buried and withdrawn one by one as the suture is made. In the lumen of the bowel the crushed serous folds separate and unroll.

same time the two loops of intestine, the afferent and the efferent; in all, therefore, four thicknesses of serous membrane closely applied to each other by the retraction of the muscular and mucous coats. The coprostatic clamp is then applied to the two loops just below the crushing clamp and is gradually tightened until the teeth bite the two loops without crushing them but also without letting them slip during the removal of the crushing clamp. The extreme edge of the crushed zone, composed of four closely applied thicknesses of serous coat, is then seized throughout its whole length by the invaginators which are applied from left to right, blade behind blade, beginning on the left with the longest handled, and ending on the right, close to the mesenteric attachment, with the shortest (Fig. 13).

The coprostatic clamp is now removed without disturbing the invaginating forceps. While an assistant holds all these upright together in one hand, handles down and points upward, the operator separates the two loops of intestine and lowers them so that they hang down one on each side of the assistant's hand hiding the points of the invaginators. The operator now joins the external coats of the two loops of gut with an oversewing stitch in silk, beginning on the right near the attachment of the mesentery and passing to the left along the base of the crushed edge. To do this the needle is carried through the serous and muscular coats, emerging at the line of demarcation between healthy and crushed intestinal walls and then the same maneuver is repeated at the point exactly opposite, the serous and muscular coats alone being again pierced (Fig. 14).

At the beginning of the suture a knot is made at the extreme right near the mesenteric attachment and the short end left rather long as a traction thread. When the continuous suture reaches the left end, it is tied again but not cut, the small end, which is therefore double, being again left long enough to pull on. The needle is laid aside on a compress until the stitch can be completed on the other side, that is, until the assistant has turned over all the forceps, so that the handles now are upward and the teeth down and the two loops of gut are thrown over into the original position, with the difference, however, that the adjoining surfaces are not only in close contact but joined by a strong silk suture. The assistant holds all the handles of the forceps in his left hand while with his right he pulls on the end of the silk coming from the left end of the suture. Taking up the needle still threaded with silk, the surgeon completes the suture from left to right. He first pulls on the thread with his left hand, thereby raising the external intestinal coat on each side of the point of the invaginator on the left.

At the same time with his right hand he inclines this invaginator slightly to the left, forcing its

point between the two folds raised by the taut silk. This maneuver can be carried out equally well by the assistant. The needle then penetrates the serous and muscular coats from the side next to the operator, emerging again exactly at the boundary between healthy and crushed intestinal wall. The thread then passes above the invaginated teeth of the first invaginator and enters the opposite wall at the limit of the crushed zone, traversing the normal gut wall obliquely and emerging through its serous and muscular coats. With his left hand the operator keeps the thread taut.

This first stitch brings together the external walls of the two loops and unites them solidly above the point of the first invaginator on the left, thereby invaginating it with the four crushed edges except for the extreme edge which is held in the teeth of the invaginator.

A second stitch is made in the same way and then a third, but the silk of the latter is not drawn quite tight because at this moment the operator, laying aside the needle, takes the first invaginator in his right hand, opens it and giving it a sharp turn to the left, removes it, at the same time tightening the thread with his left hand to close the third stitch (Fig. 15).

The fourth stitch buries the point of the second invaginator. Before tightening the sixth stitch the operator opens, turns, and removes the second invaginator, and so on until the last invaginator on the extreme right is removed and the thread tied to the original short end.

This finishes the first continuous circular suture and re-establishes the continuity of the intestinal tube. With a new needleful of silk, a second seromuscular suture buries the first one.

Finally with his fingers the operator pulls the intestinal walls gently apart from the outside, this action at the same time separating each from each the crushed fringes of each wall, now in the lumen of the bowel (Fig. 16).

The entero-anastomosis obtained in these different ways is composed of two circular concentric silk sutures, each taking in the serous and muscular coats. The lumen of the gut has not been opened and at no time has the silk been exposed to infection by intestinal micro-organisms. Healing is therefore assured and the permeability of the bowel is amply sufficient to insure the passage of fæces.

We wish to emphasize here that in the majority of cases of end-to-end anastomosis done by our method, the excellent instrument of de Martel is eminently suitable for crushing the two loops of gut simultaneously. This instrument is not only long enough but also very powerful and therefore capable of crushing easily two loops of even voluminous and hypertrophied colon.

Fig. 16. End-to-end entero-anastomosis (Group III). Left: the first seromuscular suture is finished, and the seroserous suture begun. Right: the two circular sutures are finished. In the lumen of the bowel the crushed serous folds have spread out and the passage is established.

It is necessary only to take the precaution after having removed the second branch from the closed crushing clamp, to cut the two loops of gut close to the third branch. In this way one will keep whole the edge crushed by the second branch which will be seized in all its length either with a long flat toothless forceps or with the series of invaginators.

During this procedure the first branch, being closed, acts as an admirable coprostat.

We wish to point out one objection which practice will explain. We believe that it would be worth while to make the de Martel clamp used for the first and second branches a little narrower than they are at present. This would lessen the width of the crushed zone and therefore the size of the ridge invaginated inside the anastomosis. We hope that de Martel will interest himself in our new method and will then decide whether this suggestion is worth considering.

TECHNIQUE OF A SIDE-TO-SIDE AND END-TO-SIDE ENTERO-ANASTOMOSIS

The end-to-end anastomosis technique just described is aseptic. One would proceed in exactly the same way to make a laterolateral or a terminolateral anastomosis whenever the mesentery is long enough for the intestine to be twisted.

Given these conditions, a laterolateral anastomosis can be made by the above method. A cap-shaped piece of complete bowel wall is raised by the triangular fenestrated forceps on each loop of gut. With these forceps the loops are applied to each other longitudinally and held side by side. The bases of the two caps are then seized together in a crushing clamp the blades of which are narrow and are without teeth at the ends. The ends of the blades must not extend beyond the limits of the caps. The clamp is then turned over, and the posterior surfaces of the loops joined by a seromuscular suture, beginning near the handle of the clamp. When the point of the instrument is reached, it is again turned over, the tops of the

Fig. 17. Ileosigmoidostomy, above: by means of a narrow, flat-bladed, toothless pressure forceps; below: by means of an intestinal crushing clamp, a coprostatic clamp, and invaginators.

caps projecting from it are cut away with due antiseptic precautions, and the groove in the clamp disinfected with iodine. This done, the anterior suture is finished, the completely buried clamp being removed later. Or, alternatively, the caps in juxtaposition are seized at their bases in an ordinary wide-bladed crushing clamp. This clamp is turned around its own point as though on a pivot, while the posterior deep suture is first made and then turned over into its original position. The coprostatic clamp is placed under the crushing clamp and the tops of the two caps cut clean away. As soon as the crushing clamp is removed, the extreme edge of the crushed zone is seized from end-to-end by the blades of the invaginators which are then to be covered in and removed one by one as the anterior deep suture is made.

To perform a terminolateral anastomosis, ileosigmoidostomy for example, a coprostatic clamp is first placed under the crushing clamp and the cut end of the small intestine thus closed. After the crushing clamp is removed, the extreme edge of the crushed zone is seized by two or three invaginators. The end of the intestine can thus be brought exactly beside the cap picked up in the fenestrated forceps from the muscular band of the colon. The cap and the end of the intestine are then crushed simultaneously just below the invaginators and the fenestrated forceps. The crushing clamp must now be turned over so that the posterior deep suture can be made, and the clamp is then turned back into its original position. All that emerges from the closed blades of the clamp is now carefully removed with the thermocautery; the coprostat is placed under the crushing clamp which is then removed, and the operation completed in the same manner as that described for the second and third possibility (Fig. 17).

TECHNIQUE OF GASTROJEJUNOSTOMY ANTERIOR OR POSTERIOR, AND OF LATEROLATERAL ENTERO-ANASTOMOSIS

When the mobility of the viscera is such that they can be turned freely over, the following will be found the simplest and the quickest method of performing one of the above operations aseptically by the procedure of simultaneous crushing.

The two viscera to be anastomosed being held by an assistant side by side and isoperistaltically, the operator takes up, in triangular fenestrated forceps, a cap of complete bowel wall about 6 centimeters long from each viscus, taking special care to include the mucous membrane. A strong narrow clamp without teeth seizes the bases of the two caps simultaneously and crushes them completely. The ends of the two blades must not extend beyond the lateral limits of the caps. The fenestrated forceps are removed. As the tops of the caps emerge from the closed blades of the crushing clamp, no slipping is possible at this

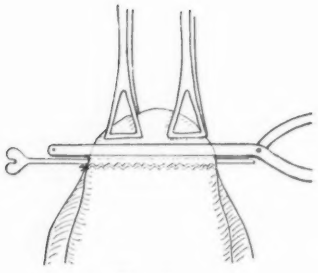

Fig. 18.

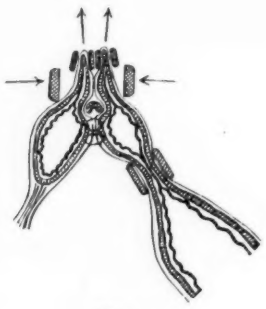

Fig. 19.

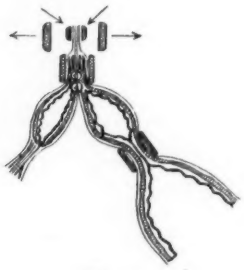

Fig. 21.

Fig. 18. Gastrojejunostomy. The two posterior sutures, made with the same needle, are completed. The thread is knotted at each end and left long as a traction thread. A fine director is laid upon the sutures to protect them. The clamp seizes simultaneously the two caps—from stomach and jejunum—and crushes them slowly without cutting their serous and mucous coats. The director can then be removed.

Fig. 19. Gastrojejunostomy. The director is laid upon the two posterior sutures and protects them. The clamp is about to seize the bases of the caps, gastric and duodenal, whose tops are held by the triangular fenestrated forceps.

Fig. 20. Gastrojejunostomy. The tops of the two crushed caps are removed, the groove in the clamp disinfected with the thermocautery, and the director protecting the two posterior sutures removed.

Fig. 21. Gastrojejunostomy. The coprostat having been placed in position and closed immediately below the clamp, the latter is now removed and the extreme edge of the crushed zone seized by the invaginators placed one behind the other, blade to blade. The coprostat must now be removed to permit the invagination of the forceps.

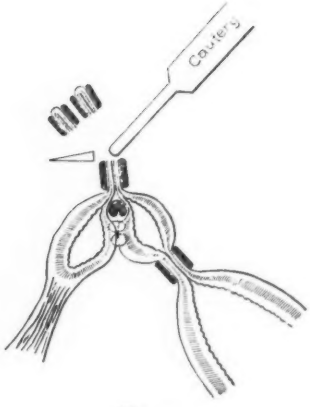

Fig. 20.

stage. The handle of the crushing clamp is turned pivot-wise around its point so that the posterior surface of the proposed anastomosis is exposed. The loops of gut are separated as far as possible and the posterior deep seromuscular suture is begun near the handle of the crushing clamp. When the other end is reached, the suture is continued around the end of the point of the crushing clamp which is thus hidden, and the instrument is turned over into its original position. The thread is knotted and the loop left as a traction thread. The tops of the two caps emerging from the blades of the crushing clamp are cut away and the groove in the clamp disinfected with iodine or the thermocautery. With the same needleful of silk, the seromuscular suture is continued toward the handle of the crushing clamp, covering the blades completely. When only two or three stitches remain to be made, the instrument is slightly opened and withdrawn, the small opening through which it passes being closed by the last stitches of the anterior deep suture and the thread tied to the end left at the beginning. It is now necessary only to make a second and external seromuscular circular suture.

At the moment of cutting away the tops of the caps, it is possible that a more or less complete slipping may occur with bleeding and escape of intestinal and gastric contents during the making of the anterior deep suture. To avoid this risk we advise the following procedure. Let us take as an example a posterior gastrojejunostomy.

The lower part of the posterior stomach wall is drawn through an opening in the mesocolon. After the proposed site for the anastomosis has been determined, the usual fine silk ligatures are put on all the veins and arteries coming from the gastro-epiploic vessels of the greater curvature. Then the first portion of the jejunum is drawn up and applied parallel to the cap of the stomach wall where the anastomosis is to be made. Coprostatic clamps or Payr-Kocher forceps are unnecessary.

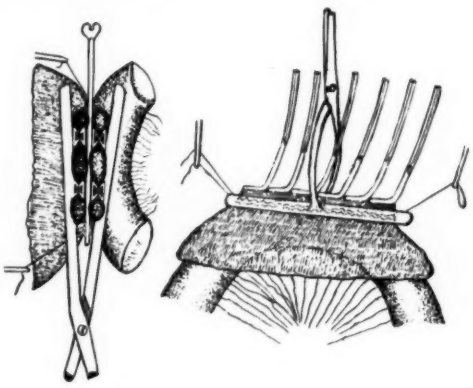

Fig. 22. Gastrojejunostomy. Bird's eye view: the director lies on the two posterior sutures, between the caps seized by the fenestrated forceps. The crushing clamp is about to seize together the bases of the two caps and crush them simultaneously. Side view: our coprostatic clamp is placed immediately under the crushing clamp at the level of the posterior sutures (invisible). The crushing clamp is removed. The edges of the crushed zone composed of four serous layers, are seized in the blades of the invaginators.

The stomach and jejunum (or alternatively the two loops of intestine) are applied together carefully and isoperistaltically and fixed at either end of the proposed opening by a long traction thread. Care must be taken so to place these stitches that they seize the lateral wall of the jejunum (or alternatively of the two loops of gut) near enough to its mesenteric attachment to allow room at the periphery for the two silk sutures and the blades of the crushing clamp.

An assistant keeps taut the traction threads so that a fold is formed in the stomach and jejunum which the operator can easily follow with a needleful of silk from one traction thread to the other, making a first sero-muscular suture from left to right, and then returning to his starting-point and with the same thread making a second suture from right to left burying the first one. The thread is knotted at each end but not cut.

A thin director is placed lengthwise over the two posterior sutures and as at each end of the suture there is a double thread, the instrument lies between the threads at either end, with its groove downward toward the suture and the smooth side uppermost. At each end the traction threads are knotted over the director and left long; the instrument is thus kept fixed in position upon the suture and will presently protect it from the grip of the crushing clamp. An assistant holds firmly the two ends of the director (Fig. 18).

The cap-shaped portion of stomach wall which is to be removed is now seized at its two ends with fenestrated triangular-bladed forceps for a length which varies with the proposed size of the opening and is slightly less than it. The same is done with the cap-shaped portion of jejunum. These two caps are now applied one against the other, thus hiding the director. It is unnecessary, and indeed unwise, to make these caps too large, for one must have, especially in the jejunum, room enough on the outer wall for the two anterior sutures.

The crushing clamp is now placed horizontally exactly over the director, between it and the triangular forceps; it first grips, and then, after a final controlling examination of the parts, crushes the two caps slowly, completely and simultaneously (Fig. 19). The director is now withdrawn backward from below the crusher by pulling on its wide end. The parts of the two caps which protrude from the crusher are removed with knife and dissecting forceps and the thermocautery or a swab soaked in tincture of iodine is passed over the groove of the crusher (Fig. 20). The stomach and jejunum are seized in the blades of the coprostatic clamp at the level of the two posterior sutures just below the crushing clamp, which is then opened and withdrawn (Fig. 21). Care must naturally be taken to use a crusher which does not cut, is not too wide, and will not exercise enough pressure to injure the peritoneal coats.

The extreme edges of the crushed part, comprising the four layers of visceral peritoneum covering the stomach and jejunum, are quickly seized from left to right by the invaginating forceps, the teeth of which must be placed exactly behind each other. The first invaginator on the left is the longest, that on the extreme right the shortest (Fig. 22).

The coprostatic clamp is now withdrawn without disturbing the invaginators. The assistant gathers up the handles of all the invaginators in his left hand, while with his right he pulls on the left traction thread.

The operator now begins the first anterior continuous silk suture, working with a straight needle. He first pierces the serous and muscular coats of the stomach, then balancing the needle above the blades of the first invaginator he enters the corresponding coats of the jejunum opposite, always following the boundary line between healthy and crushed wall (Fig. 23).

After making three stitches he takes the first invaginator from the assistant into his own right hand, gives it a turn to the left, opens and removes it, while at the same moment he tightens the

Fig. 23. Fig. 24. Fig. 25.

Fig. 23. Gastrojejunostomy. The coprostat has been removed and the forceps are invaginated one by one. The first anterior suture which is to invaginate the forceps is begun.

Fig. 24. Gastrojejunostomy. As the anterior suture is continued, the invaginating forceps are removed one by one and the folds of crushed serous membrane are freed.

Fig. 25. Gastrojejunostomy. The second suture being complete, the operator separates the walls of the anastomosis.

stitch and folds in the serous coats of the crushed edge closely applied together (Fig. 24).

At the sixth stitch the second invaginator is turned and removed and so on. While the surgeon removes the last invaginator, the assistant, whose left hand is now free, takes up and pulls on the right traction thread. The first anterior suture thus completed, the operator ties the end of it to the traction thread and starts back again with the same thread from right to left, making a second anterior seromuscular suture burying the first one.

It now remains only to separate from the outside with the fingers the two walls of the anastomotic canal. The two inner layers of peritoneum can then escape from their adherence to the outer layers which unfold and ultimately adhere. With the same movement the operator can judge the nature of the new opening (Fig. 25).

As always, the edges of the opening in the transverse mesocolon are fixed to the posterior stomach wall around the anastomosis by isolated silk stitches.

NOMENCLATURE

We have now demonstrated that our procedure makes possible the anastomosis of two hollow viscera, without the necessity of opening their lumina; and the making of a jejunal, ileal, or colic end-to-end anastomosis, of an ileocolostomy either end-to-end or end-to-side (ileosigmoidostomy, for instance) as well as of gastrojejunostomy anterior or posterior, and of a side-to-side enteroanastomosis.

The essential point of the procedure being the crushing of the two viscera *at the same time and with the same instrument*, we propose to call our method *"the method of anastomosis by simultaneous crushing" (Ecrasement simultané; Simultane Quetschung).*

CONCLUSION

This method of simultaneous crushing gives an anastomosis which is quite aseptic and is made up, externally, of two continuous circular and concentric seromuscular silk sutures. They are strong and impermeable. The silk, never having come in contact with the intestinal micro-organisms, does not irritate the serous surfaces and if one has been careful not to injure the neighboring peritoneum, there should, theoretically, be no chance of even the smallest adhesions around the anastomosis.

In the interior of the intestinal tube whose continuity has been established by this method, the crushed fringes of the mucous and muscular coats are closely applied to the equally crushed and adherent layers of serous membrane which form a sort of "nut." This, being deprived of blood, becomes detached, falls into the lumen of the bowel, and thus allows the mucous and muscular coats to be again in apposition and to join up by cicatrization.

One might perhaps have to reckon with postoperative hæmorrhage after this procedure, but so far we have not met with a single case; one must not forget in the gastrojejunostomy, the importance of prophylactic ligatures on the vessels of the greater curvature, a maneuver already employed by most prudent surgeons even in the old operation. It is also wise to tie the more important of the vessels in the submucous coat when one has incised the two external coats of the stomach.

We have also pointed out the necessity of freeing the intestine from its mesentery for a length equal to the breadth of the blades of the crusher plus 5 millimeters for the invagination of the two silk sutures; the division of the intestine is thus sufficiently far from the nutrient vessels not to bleed, and near enough to its mesenteric attachment to preserve its vitality.

It is to be remembered also that division by crushing generally insures cessation of blood-flow and that crushing instruments were specially made with this object at a time when postoperative hæmorrhages were much feared because of their frequency.

When, in a case of resection of the stomach, the operator has crushed the stomach transversely, removed the tumor, quickly passed a purse-string suture under the crushing clamp and given it to an assistant to hold while he himself opens and removes the clamp, is not the crushed border invaginated by the Lembert suture formed also of serous membrane only while the mucous and muscular coats, crushed and cut, are left to themselves in the interior of the stomach? Well, we do no more than this when we invaginate the crushed edge.

We strongly advise, besides, in order to lessen, as far as may be, the risk of postoperative hæmorrhage, the preparation of the patient beforehand by increasing the coagulability of his blood. This has been our usual practice for many years and we prefer for this purpose the intravenous injection of calcium chloride and the hypodermic injection of 20 cubic centimeters of coagulene given three-quarters of an hour before the operation. Coagulene acts visibly, especially on jagged wounds with uneven surfaces, by the formation of a solid clot, as in tooth extraction, prostatectomy, osteotomy, and intestinal surgery.

However, we must not omit to bring forward ourselves perhaps the most serious criticism of our method of gastro-enterostomy, the possible formation of a peptic ulcer at the site of the anastomosis. Because once the anastomosis is made, the two mucous membranes are not sewed together, they gape in the interior; whereas, by the old method after opening the stomach and jejunum many surgeons are in the habit of stitching the mucous membrane exactly together with fine catgut or even silk. It is not, however, always possible to make this internal circular suture of the mucous membrane beyond reproach, so that even then there exists the possibility of a secondary peptic ulcer forming at the defective points of the suture.

In this paper, we have tried to describe, as far as possible, the technique of different ways of making intestinal and gastro-intestinal anastomoses, satisfying in full the demands for that most complete asepsis which is the aim of all surgeons. We believe that our method of simultaneous crushing constitutes an advance in intestinal surgery and we trust that our fellow surgeons will give it a trial.

THE EFFECT OF ACUTE PERFORATION ON THE COURSE OF PEPTIC ULCER[1]

By ALEXIUS McGLANNAN, M.D., F.A.C.S., and HENRY F. BONGARDT, M.D., Baltimore
From the Mercy Hospital Clinic, Department of Surgery University of Maryland

MANY factors combine to cause a peptic ulcer. None are constant; any one may be present on most occasions and absent on others. Permanent cure of peptic ulcer requires the removal or control of the cause or causes.

Perforation may be the result of erosion, follow an embolic process which sets up an acute ulceration, or occur in the course of a chronic one.

A peptic ulcer heals by the production of granulation tissue which organizing fills the defect in the connective tissue coats and is covered over by columnar epithelium which grows from the edge of the mucous membrane. The glands are not regenerated.

The vigor of the reparative process varies, and is proportional to the local blood supply. After perforation the reaction on the part of the peritoneum is directed toward a limitation of the spread of the irritating fluid coming from the opening and also toward a sealing of the perforation. The relative success or failure of these efforts determines the extent and the severity of the peritonitis. When the perforation is a gradual erosion the exudate is walled off, or practical sealing of the opening may take place by inflammatory agglutination and organization.

A patient with an acute perforation seldom recovers unless the opening is closed by a surgical operation, in the course of which appropriate treatment is given to the damaged peritoneum.

The effect of operative closure of the perforation on the subsequent course of the ulcer has not yet been determined. Barber[2] perforated the pyloric region in dogs with a cautery. The wound was closed at once by inversion, with two purse string sutures; the duodenum was plicated over the anterior face of the pyloric end of the stomach, and the available omentum tacked over the site of the inversion. In all the experiments the animals recovered without any stenosis of the pyloris. The perforative wounds showed fibrous bridging and epithelization. The prompt and complete healing of these experimental perforations represents the reparative process under the best conditions. That such healing occurs in some perforated peptic ulcers is certain, but it is equally certain that in many others delayed repair is to be expected. Large crater ulcers must require a longer period and the persistence of active focal infections, of other auto-intoxications, faulty hygiene, or any other of the many factors which contribute to the original ulceration undoubtedly delay or prevent the complete healing of the ulcer even though the peritoneal reaction closes the perforation by means of fibrous scar. It is common knowledge, however, that at a later operation on one of these patients, for example, when an incisional hernia is closed, inspection of the area will often show that all evidence of the large callous ulcer has entirely disappeared.

This report is based on a study of 28 cases of perforated peptic ulcer treated in the Mercy Hospital, Baltimore, between September, 1919, and February, 1926.[3]

Two patients were negroes, one was a Japanese, and the remainder were whites. There was one white woman in the series. In all cases except one the treatment consisted in closure of the perforation and treatment of the peritonitis. In all cases the peritoneal cavity was drained, the drains being placed in accordance with the extent of peritoneal soiling. In the one exception to this rule a posterior gastro-enterostomy was done after closure of a duodenal ulcer. The patient died of peritonitis.

Nine patients died, one 17 and another 21 days after operation with symptoms of pulmonary embolism. One died on the fifty-fifth postoperative day of multiple abscesses of the liver, which developed after drainage of a subphrenic abscess and another of the abdominal wall. The remaining 6 died from peritonitis. In these cases the relation of the fatal outcome to the interval between perforation and operation was the usual long one and is shown in the table.

Two patients were operated upon in February, 1926. Both recovered and now are free from digestive symptoms. Obviously it is too soon to decide on the results.

Three patients have been lost and the result in their cases cannot be obtained.

One patient recovered from the duodenal perforation and remained well for a year and a half. He then developed sudden severe abdominal

[2] Ann. Surg., 1922, lxxv, 354.

[3] We thank the other members of the Surgical Staff of the Hospital for the privilege of reporting their cases.

[1] Read at a meeting of the American Gastro-Enterological Association, 1926.

TABLE I.—TYPE OF ULCER AND IMMEDIATE RESULT OF OPERATION

Type	Outcome	Duration of perforation in hours						Totals
		1–6	7–12	13–24	25–48	Over 48	Not stated	
Gastric	Lived	6	2	0	1	0	1	10
	Died	0	1	0	2	0	1	4
Duodenal	Lived	4	3	1	0	0	0	8
	Died	0	0	1	2	1	0	4
Location not given	Lived	1	0	0	0	0	0	1
	Died	0	0	1	0	0	0	1

TABLE II.—DURATION OF PERFORATION AND IMMEDIATE RESULT

Time in hours	1 to 6	7–12	13–24	25–48	Over 48	Not stated	Per cent
Lived	11	4	2	1	0	1	68—
Died	0	1	2	4	1	1	32+

pain with tarry stools. At operation the pyloric region was found bound down and densely adherent to the liver by a large scar. Posterior gastro-enterostomy was done and the patient is now well and free from symptoms one year after the second operation.

K. Patterson Brown[1] divides the patients in his series into four groups:

1. Those who are perfectly well, having no symptoms of any kind and who express themselves as cured. We have 7 patients who are in this group, 50 per cent.

2. Those classed as satisfactory, who have had no further ulcer symptoms, but occasional abdominal discomfort of a vague nature. They are able to work full time and live normal lives, but they exercise care with their diet. Four of our patients are in this class. One of these four has shown great improvement in the last 2 months, after the extraction of an abscessed tooth.

[1] Edinburgh M. J., 1925, xxxii, 207.

3. Those who still complain of abdominal pain, coming on at intervals and suggesting the presence of an ulcer. They have to restrict their diet, and are under medical treatment but are able to work during the quiescent periods. We have one such patient.

4. Patients who have not been improved. They continue to have symptoms of ulcer, are unable to work, and require further treatment. We have one patient of this kind.

The patients in Groups 2 and 3 probably represent those in whom the ulcer, its causes, or its healing has produced a disturbance of the physiology of the stomach or duodenum which remains without compensatory relief.

The duration of ulcer symptoms before perforation occurred, compared with the end-result, is shown in Table III. Apparently this factor is of slight influence in determining the effect of the perforation on the course of the ulcer. It is worthy of note that one patient in whom the perforation seems to have been the first indication of the presence of an ulcer, which therefore may have been an acute embolic one, made a full recovery. It is also interesting that none of the patients whose ulcer symptoms had existed for more than one year made a complete recovery.

It is our conclusion that after recovery from acute perforation of a peptic ulcer, the majority of patients go on to permanent cure of the ulcer;

TABLE III.—DURATION OF SYMPTOMS BEFORE PERFORATION AND ULTIMATE RESULT

Group	Time							Totals
	Onset with perforation	1 month	2 months	6 months	1 year	Over 1 year	Indefinite	
1	1	0	0	2	3	0	1	7
2	1	0	1	0	1	1	0	4
3	0	1	0	0	0	0	0	1
4	0	0	0	0	1	0	0	1
2nd Operation	0	0	0	0	0	1	0	1

that a few are not completely cured, but do recover sufficiently to lead a comfortable and active life; and that a very small minority have recurrence or persistence of the ulcer symptoms and that some of these patients will require secondary operations for their cure.

As far as we can judge from a study of these cases none of the deaths can be attributed to a stenosis of the pylorus, and in none of the fatal cases can we see any evidence which makes it probable that the patient would have recovered had gastro-enterostomy been performed.

In one case the need for secondary gastro-enterostomy suggests that a primary anastomosis would have been better treatment. This patient came to operation 13 hours after perforation. He had severe peritoneal reaction. In the judgment of the operator anything beyond simple closure could not be considered. One other patient needs further treatment and another operation. In his case more extensive operation might have been done with reasonable probability of success. However, in view of the fact that 10 of 13 patients made good permanent recoveries after simple closure of the perforation, it does not seem justifiable to perform a more extensive operation on these patients because 2 others will require surgery a second time. Postponement of the more extensive operation gives time for better study and preparation of the patient and for consideration of the best type of intervention to meet his needs. When the major operation is thus postponed the opportunity is given to utilize medical treatment as a postoperative measure and as an aid in planning for the second stage of the surgical treatment should this become necessary.

INTERNAL DRAINAGE OF THE GALL BLADDER AS A ROUTINE OPERATIVE PROCEDURE

Report of One Hundred Cases[1]

By WILLIAM A. STEEL, M.D., F.A.C.S., Philadelphia

A DECADE ago the controversy between the radical school of surgeons advocating cholecystectomy in all gall-bladder infections, and their conservative brothers of the cholecystotomy school was at its height. A smaller surgical group, realizing the high mortality of extirpation, but keenly aware of the frequent relapses following drainage, were searching for some safe, efficient middle ground technique. Observation had shown them one outstanding fact: That when bile from the infected gall bladder was drained outside the body, it cleared from a dirty, infected, tarry fluid, to a normal, straw colored, liver bile in from 2 to 4 days; that it continued coming through the gall bladder as normal bile, as long as drainage was maintained; and that the toxic symptoms subsided as the bile cleared. Hence if such a flow of normal bile could be maintained through the gall bladder, and passed on into the upper digestive tract, the ideal was attained.

As a result of these observations the operation of cholecystoduodenostomy was born. The new operation gained adherents. It was also found that in difficult duodenal anastomoses the gall bladder could be turned into the stomach with equally satisfactory results (1). The mortality was lower than in extirpation; and if the biliary fistula persisted, as clinical evidence seemed to show, gall-bladder surgery was relieved of its two main drawbacks.

Then in stepped the research man with his laboratory dogs, and his dogmatic application of animal end-results to fit human physiology and pathology. From several sources came laboratory proof that in dogs, when the common bile duct is not ligated, the cholecystoduodenal fistula closes rapidly, and is useless as a permanent drainage canal. Later experimental work on dogs proved that a healthy gall bladder always becomes infected from the gut to which it is anastomosed, and that the infection finally works up and invades the liver (2).

For the past 8 years, whenever practicable, we have used internal gall-bladder drainage, that is, cholecystoduodenostomy or cholecystogastrostomy, as a routine procedure in operations for infected gall bladder. It is the object of this paper to give the results in 100 such operations done between 4 and 8 years ago.

OPERATIVE TECHNIQUE

Expose the gall bladder by an upper right rectus incision. Free it from its liver attachment far enough for the fundus to lie against the point of anastomosis without tension or kinking. Do a classical end-to-side anastomosis to duodenum or stomach. Linen thread is used for the serous stitch, No. 00 chromic gut for the through and through buttonhole stitch (Figs. 1, 2, and 3). Cigarette drain is carried to the seat of the anastomosis and the drain is removed within 48 hours.

STATISTICS

All of the operations in this series were done under spinal stovaine anæsthesia, and drainage was maintained for 2 days. In 54 cases cholecystoduodenostomy was done; in 46, cholecystogastrostomy. During this period 6 cholecystectomies were done; 3 for suspected cancer of the fundus; 3 for thick brittle walled gall bladders; and 7 cholecystotomies were performed for gangrene and

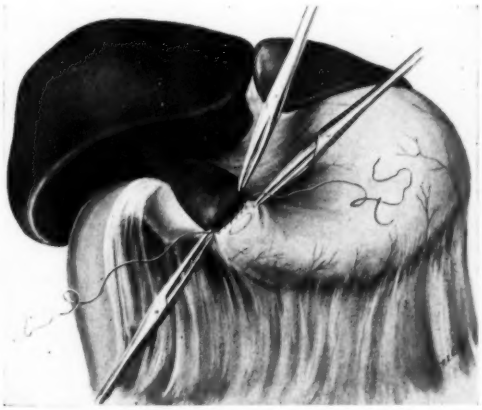

Fig. 1. The gall bladder is freed from the under surface of the liver far enough for the fundus to lie against the point of anastomosis without tension or kinking. The serous stitch of linen thread is placed posteriorly.

[1] Read before the Meeting of the Clinical Society of the Samaritan Hospital, Philadelphia, April, 1926.

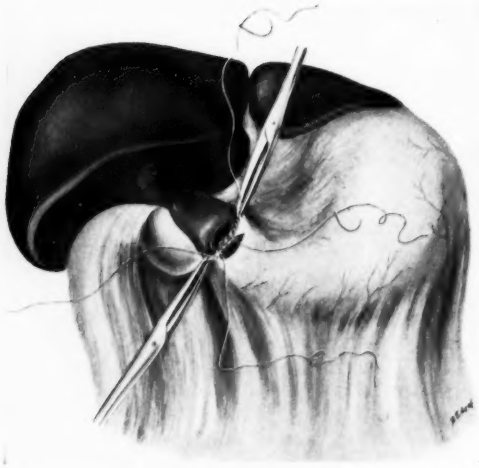

Fig. 2. The stomach and gall bladder are opened a full three-quarters of an inch. The through and through buttonhole stitch of No. 00 chromic gut is placed.

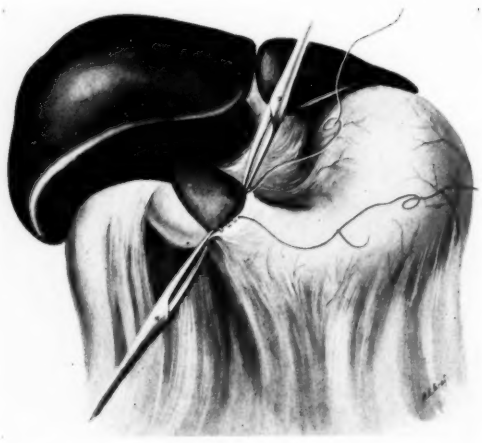

Fig. 3. The anastomosis is completed by the serous stitch. The author uses linen thread for the formation of this serous suture.

acute purulent conditions. Internal drainage was practical in 77 per cent of the cases.

MORTALITY

There was no operative mortality; the post-operative mortality was 2 per cent. One patient died on the third day of epidemic flu; one on the fourth day of hypostatic pneumonia. There have been 3 deaths in 67 subsequent operations, 1 as a result of acute pancreatitis and 2 of chronic or subacute pancreatitis. In these 3 cases, the tissues surrounding the seat of anastomosis were digested away.

I believe pancreatitis is a contra-indication to internal drainage.

PATHOLOGICAL CONDITIONS AND COMPLICATIONS

Cystic calculi (3 had reformed stones)	27
Common duct obstruction	
Stone	4
Benign	2
Malignant	2
Chronic pancreatitis	3
Gastroptosis	5
Benign pyloric stenosis	6
Catarrhal appendicitis	21
Pericystic adhesions	4
Simple cholecystitis	26
Simultaneous operations	
Appendectomy	21
Gastropexy	5
Pyloroplasty	4
Posterior gastro-enterostomy	2
Pelvic operations	7

There were 8 healthy gall bladders on inspection, all of which had given typical pre-operative gall-bladder symptoms.

The youngest patient was 18 years of age, the oldest 72. The average age was 41 years. Ninety-two patients were females, 8 males. Follow-up reports were obtained in 78 cases; 12 patients were dead of intercurrent diseases, mostly heart disease, influenza, and pneumonia. Two patients died of the cancer which had caused the pre-operative symptoms. Of the 64 cases in which the patients are living, 50 have permanent relief, 79 per cent; 8 are improved, 12 per cent; and 6 have recurrent dyspeptic symptoms, 9 per cent. In no case did jaundice, present before the operation, recur. No patients have had typical colic suggestive of stone or cystic duct obstruction. Those with calculi or advanced inflammatory gall-bladder disease gave the best consistent postoperative results.

The author had the opportunity to reopen the abdomen in 5 cases within from 8 months to 5½ years after the primary operation. The findings were as follows:

CASE 1. Miss G., 24 years old, had had a cholecystoduodenostomy 8 months previously for strawberry gall bladder, with relief of symptoms for 2 months. Operation was done for symptoms of gastric ulcer, and posterior gastroenterostomy for pyloric ulcer. She recovered and is well 7 years later.

CASE 2. Mrs. R., 44 years old, had a cholecystoduodenostomy 4 years previously for recurrent gall stones, and was well for 3½ years. The second operation was performed for incarcerated hernia in an old lower abdominal

operation scar. Operation showed an enlarged, prolapsed, leather bottle stomach. The patient died of progressive asthenia 3 weeks later.

CASE 3. Mrs. S., 42 years old, had a cholecystoduodenostomy 4 years previously for gall stones, and remained well for 3 years. The second operation was performed for symptoms of pyloric obstruction. Operation showed thickening and contraction of the pyloric muscle. Posterior gastroenterostomy was done, with complete relief. The patient died of myocardial trouble 3 years later.

CASE 4. Mrs. B., 48 years of age, had had a cholecystogastrostomy 5 years previously for strawberry gall bladder with attacks of jaundice. She was relieved of gall-bladder symptoms after operation. A second operation was done in an attempt to find the cause of intermittent hiccough which had been present for 3 years. Angular adhesions of the transverse colon to the abdominal scar were freed. The hiccough was partially relieved but the condition was probably psychic.

CASE 5. Mrs. H., 45 years old, was subjected to cholecystoduodenostomy 5½ years previously for gall stones, and remained well for 4½ years. A second operation was performed for epigastric distress and removal of keloid of the operation scar. No intra-abdominal pathological condition was found. The patient died of progressive peritonitis 7 days later. Autopsy failed to show the cause of the peritonitis. There was no leakage or infection about the exploratory opening made in the gall bladder.

FINDINGS

The exploratory findings were practically identical in all the 5 cases. The adhesions around the anastomosis were slight, and could be wiped off with a gauze sponge; they were not comparable to the dense scar tissue I have encountered in reopening the abdomen after cholecystectomy. The gall bladder in each case had the shape of a round tube about ⅜ of an inch in diameter. Its surface was vascularized and looked more like gut than gall bladder. The wall varied from 1/16 to ⅛ of an inch in thickness. The mucosa was soft. It was a patulous duct with a lumen of ⅛ to ¼ of an inch. A grooved director could be freely passed down the cystic duct and into the duodenum or stomach. The duct contained light yellow liver bile. The liver was normal to palpation and inspection. The results in these 5 cases would indicate that in the human subject with a diseased gall bladder, (1) the biliary fistula does not close but persists as an accessory bile duct; and (2) the gall bladder resists infection from the bowel and there is no ascending liver infection.

CONCLUSIONS

1. Internal drainage of the gall bladder results in a lower mortality than cholecystectomy and accomplishes the same purpose.
2. Cholecystitis does not recur as it often does after cholecystectomy.
3. Internal drainage eliminates common duct surgery.
4. For these reasons it is the operation of choice in cases of infected gall bladder.
5. It is contra-indicated in acute or subacute pancreatitis.

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SOME DETAILS IN THE REPAIR OF CICATRICIAL CONTRACTURES OF THE NECK[1]

By CHARLES N. DOWD, M.D., F.A.C.S., New York

THE deformities which follow extensive burns and scalds in the neck are sometimes very distressing. These deformities, in their advanced stages, have been pictured frequently in textbooks and surgical journals; however, if one looks for detailed descriptions of their successful treatment, the search is disappointing; not many such descriptions are to be found.

The following photographs and diagrams are presented to illustrate certain details in the treatment of these contractures by means of various forms of skin flaps. The presentation is made with the full knowledge that some of my friends advocate full thickness detached skin grafts in such cases, and with full appreciation of the good results which have been obtained by the use of such grafts.

There is abundant demand for the use of both pedicled flaps and detached full thickness skin grafts. However, it is important that we appreciate the possibilities of both of these forms of treatment, and that we select the one which is best for each individual case.

Fig. 1.

Fig. 2.

Fig. 3.

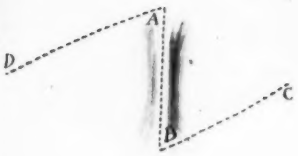

Fig. 4.

Fig. 1. Cicatricial contracture of neck. The result of scalding in infancy.

Fig. 2. Same patient as in Figure 1, showing the transverse fullness and the longitudinal shortening of the cicatricial skin. The pencils show the outline of the neck. They are easily pushed behind the band of cicatricial tissue which binds the side of the face to the chest wall.

Fig. 3. Favorable result of a single operation by the cross-over flap method.

Fig. 4. Formation of flaps for use in the cross-over method. *B* is carried upward and across toward *D*, *A* is carried downward and across toward *C*, thus lessening the transverse fullness, relaxing the contracting tissue and putting the width of two flaps into the contracted area.

Fig. 5.

Fig. 6.

Fig. 7.

Fig. 8.

Fig. 5. Cicatricial contracture from burn.

Fig. 6. Cicatricial contracture from burn. Side view.

Fig. 7. Diagram of flaps used in the first operation.

Fig. 8. Appearance of patient after first operation.

[1]Read before the American Surgical Association, Detroit, May, 1926.

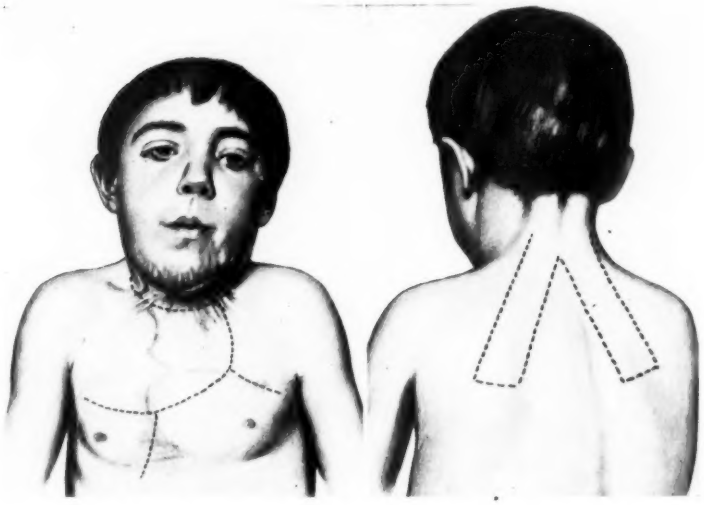

Fig. 9. Fig. 10.

Fig. 9 (left). Diagram of flaps used in second operation.
Fig. 10. Diagram of pedicled flaps taken from the back and hinged around the neck.

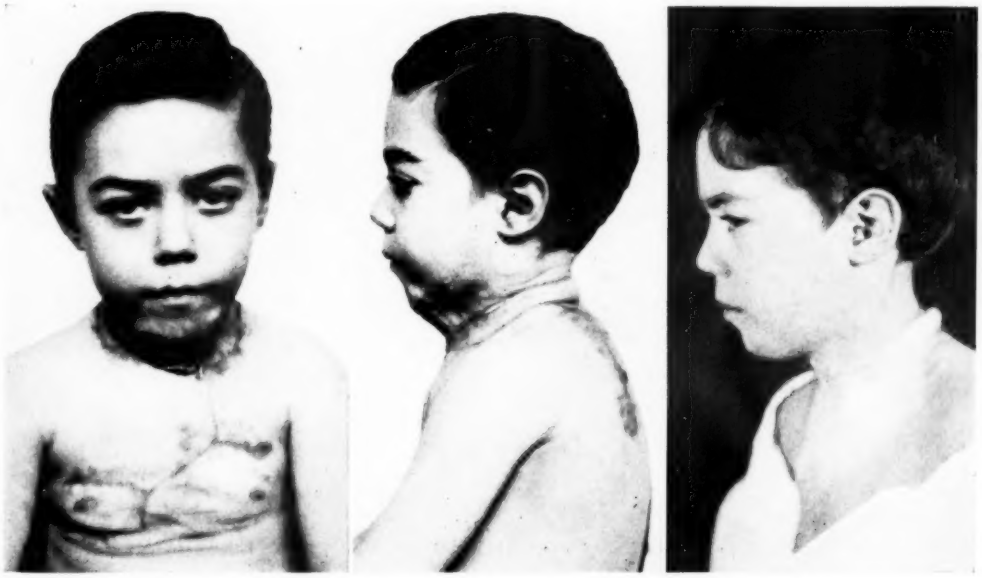

Fig. 11. Fig. 12. Fig. 13.

Fig. 11. Appearance after the second operation.
Fig. 12. Appearance after the healing of the pedicled flaps which were hinged forward from the back.
Fig. 13. Appearance after permitting the flaps to adjust themselves for 9 months. Quite a large amount of subcutaneous fat and thickened connective tissue were then dissected out from beneath the chin and the flaps readjusted so as to relieve the small longitudinal median band.

Fig. 14.

Fig. 14. Illustrating the amount of extension of the head and the outline of the neck after the operations previously described.

Fig. 15.

Fig. 16.

Fig. 15. Appearance while a small median band remained which was irritated by the clothing.

Fig. 16. Appearance on discharge from the hospital.

CASE 1. A boy of eleven and a half years was scalded when one year and 9 months old. His neck had been persistently massaged and rubbed with oil during the intervening years. The cicatricial skin was thin and pliable, but it was short from above down, as is characteristic of these cicatrices, although laterally there was more than enough skin to encircle the neck. The cicatrix stood out from the neck almost like a guy rope, extending from the outer side of the chin to the chest wall. A single operation by the cross-flap method relieved the greater part of the contracture, allowing free motion of the head and neck, and relieving the downward traction on the right side of the mouth. The result of this single operation was so good that we could never obtain permission for further adjustment.

This case illustrates two important factors:

1. Cicatricial skin may lose its thickening and become pliable. The original wound must have been deep, else there would not have been so much contracture. Yet during this long period the cicatricial skin had become thin and pliable and well suited for use in flap formation. This is important, since some very skillful surgeons have advocated the ablation of the cicatricial skin as a preparation for flap implantation.

2. Cross-over flaps are very useful in cases in which there is shortening in one direction and undue fullness in the other. Their use was first called to my attention by my colleague, Dr. Frank S. Mathews. I was treating with good success by means of full thickness skin grafts cases of contracture from burns, and presented a paper on the subject before the New York Surgical Society. But I found that Dr. Mathews was getting more prompt results from cross-over flaps so that I have used them more or less ever since. Dr. Mathews devised the plan independently, but I learn that Piechard had used a somewhat similar plan in plastic operations in the axilla. Figure 4 illustrates the method.

CASE 2. The second case, a boy of 6 years, was brought to the Roosevelt Hospital 6 months after receiving a severe burn. The extensive mass of scar tissue is shown in Figures 5 and 6. It extended from the entire lower part of the face downward on to the chest and drew the skin down to the manubrium and held it there so firmly that the head could not be extended without opening the mouth. Most of the scar tissue was thick. There were longitudinal bands in it. In the middle there was an ulcer 1 inch in diameter. On pinching the skin, one found the usual excess of lateral tissue and an extreme shortage of longitudinal tissue. It was evident, however, that this cicatricial skin had some possibilities for usefulness.

The first operation consisted in the formation of cross-over flaps in the front of the neck, and in the sliding upward of a pedicled flap from the chest so as partially to fill in the defect thus made. Seven weeks later, a long transverse incision was made across the neck so as to leave an apron of cicatricial skin beneath the chin and body of the jaw. This was pushed up beneath the jaw and stitched there. Pedicled flaps were then swung upward again from the chest. These two operations gave very definite improvement in the condition.

After another 7 weeks a cut was made through the skin around the entire left side of the neck and carried across the median line in front, permitting extension of the head to the normal degree. A flap, 5 by 2½ inches in size, with its pedicle at the nape of the neck, was raised from the left scapular region and swung around into the defect. This flap held well and gave great

improvement. Four weeks later, a similar procedure was carried out on the right side. This also held well. After the healing there was abundant cutaneous tissue in the front part of the neck, but it showed more thickening than was desired and there was a tendency to form a median longitudinal band. The boy was therefore sent home for 9 months to learn how much adaptability the newly adjusted tissue would have.

On his return to the hospital, an opening was made under the chin. The subcutaneous fat and thickened tissue were removed in a considerable amount, and the flaps were readjusted so as to relieve the small longitudinal median band. This gave great improvement.

He was seen again a year later. The result was wonderfully good as is shown in the accompanying photographs. There was a slight tendency to ulceration in the median line; hence another small plastic operation was done to remedy this defect.

This case was noteworthy in many respects, not the least of which was the willingness of patient and his relatives to come and go as desired so that the ultimate adjustment of tissues could be obtained. A very small part of the original scar tissue was sacrificed. The skin thinned out with time and adjusted itself to the underlying tissues so that the defect is of little importance. He has normal motion of his head, is a particularly good looking child, and is able to go about his play and his school duties without embarrassment, and it is fair to believe that his injury will not form a material handicap in his later career.

Fig. 17. Case 3. Showing a very broad shortened cicatricial area. A case particularly well adapted for the use of pedicled flaps hinged from the back.

Case 3. In this patient (Fig. 17) we find an extreme degree of the longitudinal shortening and the transverse fullness. A sheet of cicatricial tissue extends from the border of the jaw to the chest, obliterating the outline of the neck itself. This case was particularly suitable for the use of pedicled flaps hinged forward from the scapular region.

At the present time the surgeon in dealing with this type of contracture must carefully consider the relative merits of full thickness skin grafts and of pedicled flaps. Of late there has been much progress in the use of the full thickness grafts, and both their advantages and their disadvantages are being better appreciated. Blair makes the following judicial and satisfactory statement: "Pedicled flaps when properly handled are more certain of complete success, and, if taken from the neighborhood, are apt to have a better color. . . . The full thickness graft is somewhat uncertain of result, is exacting in its technique, requires 3 weeks before it can be considered safe, and in children and young adults may develop red corded scars months after an apparently perfect take, yet it has a place in surgery that is not as well filled by either of the two preceding" (pedicled flaps and Thiersch grafts).

Most surgeons will use pedicled flaps when there is available tissue for their formation. When such tissue is not available, full thickness skin grafts will be used. For instance, Blair describes a patient in whom the cicatrix pulled the lower lip so far downward as to evert it and expose a large area of its mucous membrane. Three full thickness skin grafts were applied at three different operations. Manifestly there was not enough available skin to form efficient pedicled flaps for this case, and Dr. Blair and the patient are to be congratulated on the good result obtained under these conditions.

PROLAPSE OF THE URETHRA IN FEMALE CHILDREN

By THOMAS N. HEPBURN, A.M., M.D., F.A.C.S., Hartford, Connecticut

SIX years ago[1] I reported a case of prolapse of the urethra in a 5-year-old girl and described a new operative procedure for its cure.

My conclusions in 1920 were that:

1. Prolapse of the female urethra is a true hernia, the result of strain and congenitally poor tissues.

2. The operation of choice for prolapse of the urethra in girls is through a suprapubic incision, by which route the prolapse is easily reduced and the anterior wall of the bladder is anchored to the periosteum of the pubic bone and anterior abdominal wall.

3. There is no reason why this simple operative procedure should not be equally applicable to prolapse in adult women.

Since 1920 I have used this operation in two adults with such ease and success that I wish to present illustrations, in the hope that others may be induced to try it instead of the older procedures of resection.

Figure 1 shows the appearance of the prolapse between the labia. Note that it is a sliding, or hernia, of the whole urethral structure, and not a mere eversion of mucous membrane. In children, because the vagina is small, the only operative recourse has been a resection of the prolapsed urethra—a sort of circumcision.

Figure 2 shows both anterior and sagittal views of the suprapubic preperitoneal method of freeing

[1]Surg., Gynec. & Obst., 1920, xxxi, 83.

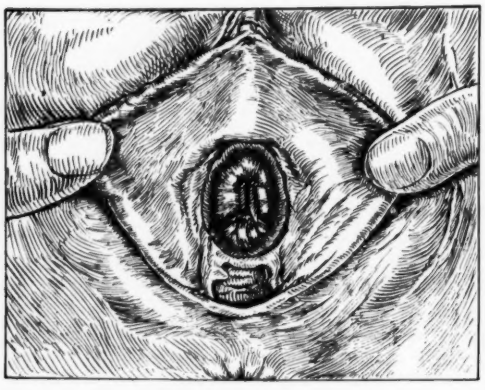

Fig. 1. Prolapse of the urethra as it appears when the labia minora are pulled aside.

Fig. 2. Patient in Trendelenburg position. Midline suprapubic incision. Bladder exposed retroperitoneally and dissected free from its prevesical attachments.

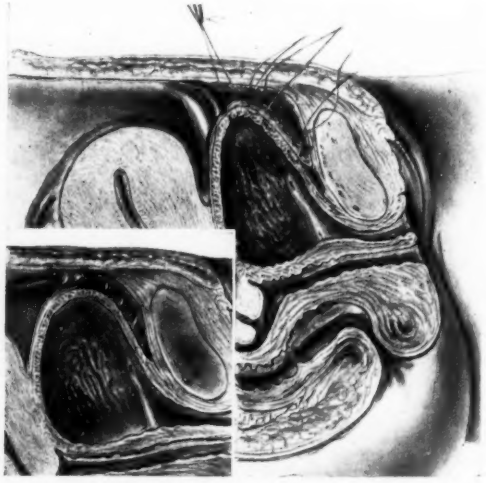

Fig. 3. When the neck of the bladder is freed enough so that traction on the bladder reduces the prolapse, it is anchored with 20-day catgut.

the neck of the bladder by blunt dissection with the finger. The urethra becomes prolapsed because of the poor attachment of the bladder neck to its surrounding structures. Therefore, when the finger is run down in the prevesical space, the neck of the bladder separates with little resistance or bleeding, down to the urethra.

Figure 3 shows how the hernia or prolapse of the urethra is reduced by traction on a suture in the dome of the bladder. In this drawn-up position, the anterior bladder wall is sutured to the structures in front of it—usually to the periosteum of the pubic bone and the posterior fascia of the rectus muscle. The legs must be apart so that an assistant can report when the prolapse is reduced, and whether it stays reduced after the stitches are placed.

The wound is closed around a rubber tissue drain to the prevesical space.

In the postoperative care, my only caution is that the patient should void frequently so that the dilated bladder may not be acted on by any sudden intra-abdominal pressure, such as may be caused by a cough or a sneeze, and the sutures thus torn before the postoperative adhesions have thoroughly anchored the bladder.

ENTEROMESENTERIC CYSTS

By JOHN A. GREEN, M.D., F.A.C.S., Rockford, Illinois
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ENTEROMESENTERIC cysts form a definite benign group having definite characteristics and are to be differentiated from the group arising from the wolffian body, dermoid cysts, parasitic cysts, and malignant cysts, which contain intestinal elements.

The etiology is not definitely known. Enteromesenteric cysts are usually connected with the bowel or its mesentery, the most common site being near the terminal ileum. How the "split off" exactly occurs to cause their formation, is as yet not definitely determined.

They may be single or multiple, large or small, located according to Ewing (1) in the wall of the intestine, and usually in the lower ileum; (2) at a point of Meckel's diverticulum (Roth); or (3) in the mesentery or near the navel (Wyss).

They may originate in the musculature or serosa of the intestinal wall or in diverticula and they show their persistent attachment at the site of origin. It is believed by some (Shallow, 7) that mesenteric cysts have a common origin in the diverticula of the ileum and cæcum. There are probably several modes of origin. Many originate from Meckel's diverticulum and are located in the lower ileum, or at the navel. These may be referred to the omphalomesenteric duct.

The term "ento-dermoid" has been employed by Benecke to designate enteric cysts which arise from definitely misplaced portions of the intestine. Many of these lie in the mesentery and are multiple.

Enterocystomata (ciliated epithelial cysts) are congenital cysts the walls of which correspond more or less completely to the structure of the intestinal canal and their origin is probably from the epithelium of the neural canal.

In a case reported by Strode and Fennel (8) the cysts were multiple, located in the ileum near the cæcal junction and differed in construction. They contend that the origin of the cysts came from a misplacement of the entoderm epithelial cells in the wall of the gut.

Aschner (1), reviewing 20 cases from the literature, found that the enterocystomata described by most writers were due to faulty involution of the omphalomesenteric duct but in his opinion conclusive proof of this theory must await more extensive observations.

Higgins and Lloyd (5) classify all mesenteric cysts into (1) those of embryonic origin arising from the mesodermal remnants, incarcerated behind the developing peritoneum and subsequently migrating forward between its layers; and (2) those of intestinal origin arising from the bowel during development as diverticula or possibly derived sometimes from persistent portions of the vitelline duct.

Some anomalous and heretofore unclassified cysts are true mesenteric cysts which have developed from the mesodermal remnants behind the peritoneum but which, unlike the ordinary mesenteric cysts, have not moved anteriorly into the developing fold.

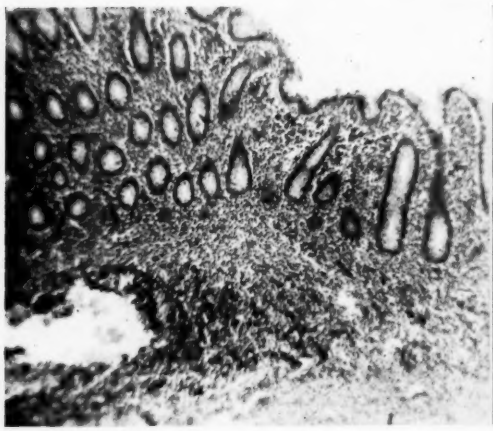

Fig. 1. Case 1. Wall of cyst—thinner portions—showing mucosa.

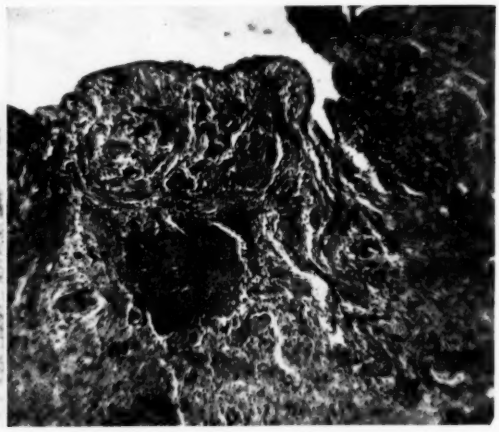

Fig. 2. Case 1. Wall of cyst showing inflammatory changes.

LOCATION OF THE CYSTS

The majority of this group of cysts, as before stated, occur in the mesentery of the ileum and more often near the terminal ileum. They may, however, occur in any other part of the intestinal canal. Tugulea and Balan (9) reported a large multilocular cyst in the mesentery of the transverse colon near the hepatic flexure which arose from the mesentery; and Carter (3) reported a case in which the cyst was continuous with the jejunum; and Waugh (10) reported a congenital cyst of the duodenum causing an obstruction from pressure.

CHARACTER OF THE CYSTS

Enteric cysts may be single or multiple, large or small. The contents are mucinous, colorless, or yellowish, or brownish. In Rietti's case (6) the cyst contained a milky fluid. The wall of the cyst resembles that of the intestine and may contain smooth muscle, mucosa, crypts, lymphoid tissue and a lining of cylindrical cuboidal, or stratified epithelium.

Secondary changes in the cyst may destroy much or all of the epithelial lining and many stages of atrophy of the muscle tissue has been observed (Niossi).

SYMPTOMS

The symptoms, aside from the presence of a tumor mass, are indefinite. History of repeated attacks of abdominal pain associated with nausea, vomiting, and often diarrhœa alternating with constipation are significant. The diagnosis, however, is difficult and is generally not made until operation or autopsy.

TREATMENT

Treatment may be by aspiration, marsupialization, enucleation, excision, or resection. Enucleation or resection are the operations of choice. Aspiration and marsupialization are obsolete except in rare cases. The following cases present some interesting features.

Case 1. Master Wm. A., age 6, was referred by Dr. R. P. Kile, Rockford, and brought to Rockford hospital, August 5, 1922, suffering from abdominal pain, fever, persistent vomiting and inability to move the bowels. This condition had been present for the past 24 hours, beginning suddenly with acute abdominal pain throughout the upper abdomen, followed by nausea and vomiting and rather marked prostration. Laxatives and enemas given by the patient's mother were without result. The symptoms had all become markedly exaggerated.

The patient had had the minor diseases of childhood and had always been a healthy boy. History of discharging navel for 3 years after birth but this had not been present for the past 3 years. About 2 years ago the mother noticed an epigastric swelling but because the child did not complain, she decided it was of small consequence.

At examination the child appeared acutely ill, with temperature of 103/2, pulse 138, facies flushed, skin dry, and considerable pain. Tonsils were moderately enlarged, teeth fairly good. Glandular system, neck, epitrochlear, axillæ, and groins were negative.

Respirations were rapid, negative to precussion, with some coarse râles in both chests, heart negative.

Neither kidney was palpable. The upper abdomen was distended and in the median line about one inch above the umbilicus a firm, irregular mass the size of the double fist could be outlined. This seemed to be attached to and was movable with the markedly distended bowel that surrounded it. There was definite muscle spasm and pain during manipulation of this area. The entire abdomen was tym-

Fig. 3. Case 2. Photograph of specimen showing diverticulum. This was a unilocular cyst, measuring 14 by 4 by 4 centimeters.

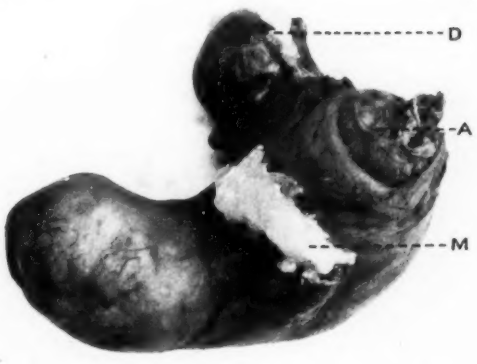

Fig. 4. Case 2. Photograph of specimen showing *a*, point of attachment; *d*, diverticulum; *m*, mucoid contents exuding through area where section was removed.

panitic. Enemas given since entrance to hospital were returned clear.

A diagnosis of acute intestinal obstruction due to some variety of tumor was made and the patient was sent to the operating room.

The abdomen was opened by a high incision about 1 inch to the right of the median line. A large, multilocular cyst in the mesentery of the transverse colon was exposed. As a result of twisting and pressure the bowel was completely obstructed. The cyst apparently involved part of the wall of the transverse colon. About three-fourths lay anterior to the plane of the bowel with the remainder posterior. The blood vessels of the mesentery extending over the cyst wall were greatly distended and tortuous.

Because of the rather desperate condition of the patient resection was considered inadvisable. The anterior portion of the cyst was therefore resected and the remainder marsupialized. The remaining portion was packed with gauze. Convalescence after a rather stormy two days was uneventful. The packings were continued over several weeks and the opening gradually closed, and has remained so.

Examination January 16, 1926, nearly 3 years later, shows no evidence of a return and the child is apparently normal in every way.

The pathological report by Dr. Henrietta Calhoun is as follows: The tissue represents a portion of a multilocular cyst, which was filled with a clear yellow serous fluid. The wall varies in thickness and the inner surface is thrown into smooth folds. Sections were made from two portions of the cyst wall. The thicker portion shows no mucosa, but has a firm connective tissue lining, in the outer portion of which are atrophic muscle fibers arranged in an inner circular and an outer longitudinal layer. In the outer portion of the cyst wall is a nerve plexus and the peritoneal covering shows œdema and round cell infiltration. The inner layers show focal collections of round cells, and in one area there is a connective-tissue scar, the central portion of which still shows round cells. This represents a chronic inflammatory process in this portion of the cyst wall.

A section through the thinner portion of the cyst shows the normal structure of the intestinal wall, with glandular mucosa showing many goblet cells, and solitary lymph follicles. There is no evidence of any malignancy. The picture is that of a true enteric cyst.

The interesting points in this case are: (1) the location of the cyst in the mesentery of the transverse colon while the cyst itself shows the structure of small intestine; and (2) the fact that packing following marsupialization apparently prevented a return though it was carried out more as a temporary procedure. I do not think the end-result would have been so satisfactory if the mucosa had not undergone degenerative changes from pressure and inflammatory changes from the obstruction.

Case 2. The second case, Mr. J. B., age 56, referred by Dr. S. C. Andrus, Rockford, was examined January 15,

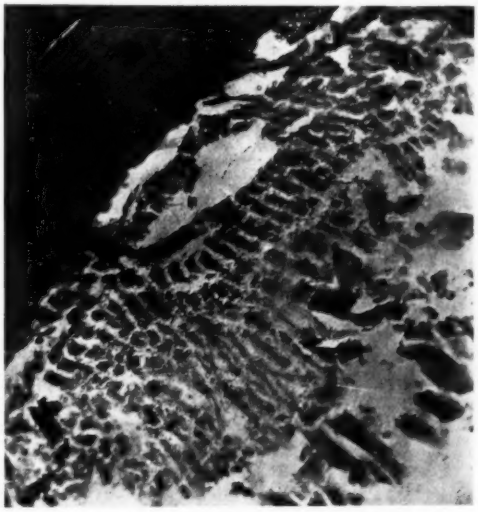

Fig. 5. Case 2. Section from diverticulum showing remnants of a necrotic mucosa lining the cyst. The structural arrangement is that of the intestinal mucosa. Section from the main cyst shows loss of this structure.

1926, complaining of a dull dragging pain in the lower right quadrant of the abdomen. The condition has been present for the past 15 years. The patient was first conscious of it after a fall, at which time he struck this region against the corner of a box. Since then he has had attacks of sharp right sided pain occurring at irregular intervals and lasting about 24 hours. This condition continued until about 2 years ago and since then the pain has been of a dull dragging type, not severe but annoying. For some years past he has noticed a mass in the lower right quadrant of the abdomen and thinks this has gradually increased in size.

His general health has been fairly good. The bowels are slightly constipated all the time. No diarrhœa.

Physical examination is negative except for irregular firm tumor mass easily outlined in the lower right quadrant of the abdomen. This mass is movable with change of position and can be grasped with the fingers when the patient turns on the left side. There is no pain during manipulation and no evidence of abdominal irritation.

Blood examination showed red blood cells 4,650,000; white blood cells 8,900; hæmoglobin, 80 per cent; Wassermann negative. Urine examinations were negative. The X-ray examination by Dr. H. W. Ackemann showed normal kidney shadows. The fluoroscopic examination with barium was negative. A vague outline of the tumor mass was demonstrated. A diagnosis of probable cystic abdominal tumor of unknown origin was made. The abdomen was opened January 21, 1926, by a right rectus incision and the tumor mass exposed. It was irregular in shape, cystic, and attached to the terminal ileum and was for the most part retroperitoneal. It was easily removed and the retroperitoneal space partially closed after 1 Penrose drain had been inserted. The convalescence was normal and the skin wound healed primarily. Patient left the hospital 12 days after the operation.

The pathological report by Dr. Henrietta Calhoun is as follows:

The specimen is that of a unilocular cyst, cylindrical in shape, measuring 14 by 4 by 4 centimeters, with a diverticulum 4 centimeters long extending out at one side. The cavity of the diverticulum is directly continuous with that of the main cyst. The cyst was evidently attached, the outer coat being continuous with the outer layer of same adherent structure. The inner coats are entire. The contents show a thick white mucoid substance which may be seen in the gross specimen at the places where specimens were removed for microscopic section. Microscopic examination shows a dense cyst wall on which circular muscle fibers can be distinguished. The lining shows in places the definite framework of the mucosa of the small intestines. The glandular cellular structures have become necrotic, but the supporting tissue is still characteristic. This is an enteric cyst which has undoubtedly developed from a diverticulum. It is interesting to note the diverticulum on the cyst itself.

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A SPLINT FOR OVERCOMING CONTRACTURES OF THE FINGERS

By ALBERT H. MONTGOMERY, M.D., Chicago

CONTRACTURES of the fingers due to purulent or traumatic inflammations about the tendons or to ischæmic myositis, have been successfully treated in recent years by some form of gradual traction and manipulation. Previously, various types of operative treatment had been used but the results were so poor that Robert Jones[1] announced, a few years ago, that he had given up all forms of operation for this condition and had obtained much better results through the gradual stretching of the contracted tissues by means of splints.

In carrying out this treatment, Jones used rubber elastic traction. The elastic bands were fixed to the fingers by adhesive plaster and attached to the crossbar of a frame which was bandaged to the forearm and extended beyond the fingers. This apparatus was fairly satisfactory but had the disadvantage that the traction could not be released to give the parts an occasional rest, without removing either the bandage from the arm or the adhesive plaster from the fingers. In some cases this led to pressure sores from the continuous traction.

To overcome this drawback, I have used the splint shown in Figure 1 with good success.

The combination is made up of an old, comfortably fitting, walking glove of strong material with a good wrist clasp. Strips of rubber about one half inch wide, cut from a discarded auto-

[1]Jones, Sir Robert. Injuries to Joints. 2nd ed. London: Henry Frowde and Hodder and Stoughton, 1922, p. 51.

Fig. 1.

mobile tire tube, are sewed to the tips of the glove fingers. The other ends of these strips are fastened by tying or sewing them to the crossbar of a frame of galvanized wire bent in the form of a U. The ends of this wire frame should be twisted in a loop at about the level of the wrist of the glove. An ordinary curtain pin is fixed to either side of the glove at the wrist, and hooked into the looped end of the wire frame. These pins serve to steady the frame and to give countertraction to the elastic bands.

The amount of traction employed can be regulated by simply changing the position of the pins in the sides of the glove. If the fingers begin to pain and the patient wishes to release the traction for a few minutes, it is only necessary to unhook the pins from the wire loops, and all pulling ceases. When the fingers are comfortable, the traction can be started again by hooking the pins into the loops. Should it be desirable at any time to free the hand from the splint, it is only necessary to remove the glove without dismantling the splint. It can be reapplied by slipping the hand back into the glove and snapping the wrist clasp.

In a personal communication Dr. Allen Kanavel has called attention to the tendency of straight splints to cause a bending forward at the metacarpophalangeal joints with hyperextension of the first phalanges. As a result of this, the lumbrical muscles are stretched and their function, which is so important in the use of the hand, is weakened or destroyed. This serious defect can be avoided by bending the side wires of the splint

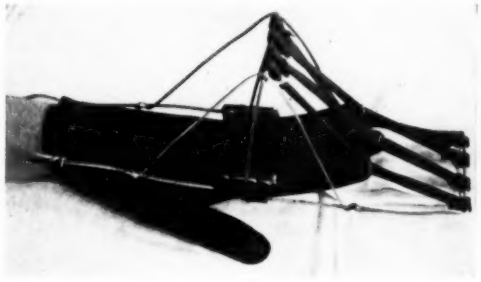

Fig. 2.

downward at an obtuse angle, with the apex on a line with the metacarpophalangeal joints. By thus flexing the first phalanges the lumbrical muscles are relaxed while traction is continued on the contracted fingers. To produce countertraction upward, a band of rubber extending across from one lateral wire to the other should be placed like a sling under the metacarpophalangeal joints.

The use of this splint (Fig. 1) will secure almost complete extension of the fingers. However, just before complete extension is reached the pull is too straight in the axis of the arm to be very effective, and more of an upward pull is needed in order to obtain full extension. To get this upward traction, a wire bridge is soldered to the U-shaped frame and the rubber strips are fastened to the crossbar of the bridge at one end and to the crossbar of the frame at the other end. The finger tips of the glove are sewed to the middle of the rubber strips. For countertraction downward, a piece of rubber about 2 inches wide is fastened to either side of the arms of the frame so that it will exert pressure over the metacarpophalangeal joints. In all other respects the splint is similar to the one previously described. It is illustrated in Figure 2, which is self explanatory.

PRIMARY THYROIDECTOMY FOR EXOPHTHALMIC GOITER

With a Report of One Hundred and Twenty Cases

By ARNOLD S. JACKSON, M.D., Madison, Wisconsin
Jackson Clinic

THE problems confronting the surgeon in the management and treatment of exophthalmic goiter have been so simplified within recent years that the operative mortality has been reduced to a very low figure. Statistics from various institutions based on a study of a considerable number of operations show a mortality rate of from 1 to 5 per cent on various series of cases. Statistics have been quoted from a large number of hospitals showing a considerably higher mortality, but in many such institutions the figures were based on a limited group of cases.

Several factors have been important in this reduction of the death rate following operation. In the early days of thyroid surgery, before there was a clear understanding of the beginning signs and symptoms of hyperthyroidism, patients were brought to the surgeon in the late stages of the disease. After marked visceral changes had occurred, these patients not only offered a high operative risk, but a greatly diminished opportunity for complete restoration of health. The general dissemination of knowledge regarding the diagnosis and treatment of cases of toxic goiter has enabled the family physician to recognize these cases in their incipiency. Patients are coming to operation now before the complications of chronic myocarditis and chronic nephritis have occurred. Thus, the surgeon must acknowledge the grateful assistance he has received as a result of the quickened diagnostic sense of the physician.

It is also true that the art of surgery has made great strides in recent years, not in individual brilliancy but in the perfection of operative team work. In major operations the element of time may be the deciding factor between life and death, and the present day swiftly moving surgical team certainly functions more rapidly and smoothly than did the individual surgeon. The time required for goiter operations has been reduced from hours to minutes. Following a local anæsthetic and a thyroidectomy seldom consuming more than 30 to 50 minutes from the time the patient enters until he leaves the operating room, there is little appreciable change in his general condition. The patients are wide awake on returning to their rooms and may leave the hospital in 5 days. Formerly this convalescence often extended over a period of weeks.

By aiding the physician and the surgeon more accurately to judge the patient's condition, the basal metabolic unit has likewise proved another important factor in lowering the mortality in exophthalmic goiter.

Since Kocher first successfully performed thyroidectomy for this disease, however, the most important step in the successful treatment of exophthalmic goiter has been the discovery of the efficacy of iodine as an aid to surgery. Four years have elapsed since Plummer made this notable contribution to medical science, and during this time the treatment of exophthalmic goiter has been almost revolutionized. First the dreaded postoperative hyperthyroid reaction was eliminated, and then the often fatal crises were overcome. Ligations were gradually abandoned and finally the multiple stage operation was discarded. Within the past year or two, considerable knowledge regarding this form of treatment has been accumulated. This series of 120 cases in which only primary thyroidectomy has been performed is presented to show the remarkable benefit to be derived from the use of iodine. Previous to the discovery of the efficacy of iodine as an aid to surgery in the treatment of this condition, there remained considerable room for argument regarding the merits of the various therapeutic measures. Those who were fortunate enough to realize early its strikingly beneficial effects were quick to disregard other methods.

In October, 1922, I began using iodine in the pre-operative preparation of patients with exophthalmic goiter. Although I had studied with and observed the work of Plummer with these cases, I did not at first appreciate the real significance of this discovery. Early in my work iodine was used in very small doses and with considerable hesitancy. Gradually the dosage was increased while the period of pre-operative preparation was shortened. Attention was called to the remarkable change in the pathological picture of the gland, hyperplasia being replaced by colloid, the gland tending to revert to normal. These observations have since been confirmed by the studies of Cattell and Rienhoff. The use of iodine postoperatively proved of great benefit and was an important factor in the gradual elimination of the multiple stage operations. Since June, 1924, no

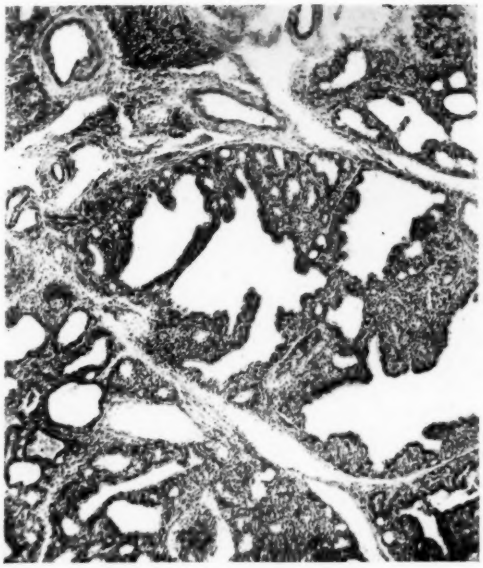

Fig. 1. Section of an exophthalmic goiter from a patient who had received no iodine previous to operation. The characteristic appearance is that of infolding of the epithelium and large epithelial cells.

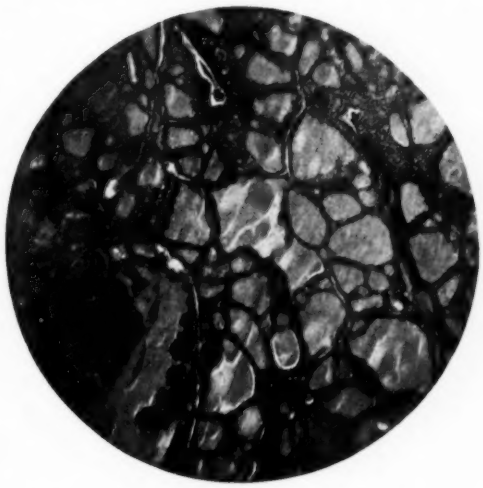

Fig. 2. Section from Case 30854 showing marked contrast to pathological appearance of gland in which iodine had not been administered before operation. Colloid may be seen replacing areas of hyperplasia. One section of infolding epithelium still persists.

ligations have been performed. The 120 cases here reported have not been selected but represent a consecutive series. Many of them were extremely bad risk cases that formerly would have been subjected to weeks or even months of hospitalization with numerous operations or tedious medical treatment.

PRE-OPERATIVE TREATMENT

As we have gained confidence in the use of iodine as a pre-operative measure, we have decreased the number of cases requiring hospitalization as well as the length of time required for preparation. The average period of preparation in this series of patients was 1 week; and the longest period of preparation was 2 weeks. About one in every three patients received hospital preparation.

As soon as the diagnosis is determined and the metabolic rate ascertained, the patient is fully acquainted with his condition. In order to gain the patient's confidence, we believe that he should thoroughly understand his disease, the methods of treatment and the necessity for treatment. Even after careful explanation, we frequently find that patients with this condition tend to minimize their ailment as do those with tuberculosis. In order to impress upon them the unfortunate consequences resulting from long delay, they should be allowed to converse with other patients. It is a mistake to start out by urging operation. If the patient is properly prepared and his confidence gained, he will not only expect but ask for operation in due time.

We give our patients printed directions covering not only the pre-operative treatment, but the immediate postoperative care and later convalescence. Patients are urged to refrain from all except trivial home duties, to add at least 3 hours of daily sleep or rest to their regular schedule, and to increase the diet to the equivalent of 4,500 calories a day. Abstinence from coffee and other stimulants are the only dietary restrictions. To quiet the nervous system 1½ grains luminal is given daily. Iodine, of course, has a markedly beneficial effect in this respect and by quieting the heart action tends to induce sleep and rest. Patients are usually told to take 10 drops of Lugol's solution before meals and at bed time and to return in 5 days for another metabolic test. About 35 per cent of the patients in this series were in such condition as to require hospital preparation. Either there had been a marked weight and strength loss, or cardiac complications had occurred. Within 2 or 3 days even these patients are out of bed for an increasing length of time each day, and operation is not considered until the patient is able to walk alone. Either on account of the

Fig. 3. Severe case of exophthalmic goiter in a boy 20 years old. Admitted in a gastro-intestinal crisis with a history of having lost 40 pounds in 3 weeks. Basal metabolic rate reduced from plus 80 per cent to plus 65 per cent in 10 days.

Fig. 4. Same patient (Case No. 30854) 3 weeks after primary thyroidectomy. Patient hospitalized for only 5 days including before and after care.

long duration of the disease with the consequent emaciation and weakness, or because of extreme toxicity, it may be necessary to prepare the patient for 2 weeks, or longer. No patient in this series received a longer period of preparation than 2 weeks, but I should not hesitate to take more time should there be any indication for it. We have saved our patients an item of considerable expense by allowing them to take their preparation at home or in a hotel, and by shortening their stay in the hospital. Operation for exophthalmic goiter should never be looked upon in the light of an emergency.

If the patient has made a sufficient degree of clinical improvement during this time, we see no reason for further delaying operation. Although we realize that in many cases a considerable improvement would result from longer treatment, delay is tedious and expensive for the patient. The degree of improvement may be judged first of all by the general appearance of the patient. The change is often remarkable. The frightened, anxious, staring expression is no longer present. Exophthalmos persists until after operation, but there is an entire change in the facial expression. The face fills out and the haggard appearance is gone. The continual restless, purposeless movements are replaced by a quiet demeanor. There is a noticeable slowing down of the pulse rate, and the patient no longer complains of a rapid, pounding heart. The appetite, which at one time may have been ravenous, but on the verge of a crisis is replaced by nausea and vomiting, again returns. Patients gain strength as if by magic. Those who have been bedridden for weeks are able to be up and take a few steps the first week. Physical examination often shows that the characteristic thrill and bruit have disappeared. The pulse pressure decreases as the clinical condition improves. In this series there was an average reduction in the basal metabolic rate of plus 16 per cent, the rate averaging plus 46 per cent before treatment and plus 30 per cent after treatment. When the rate was very high this reduction was considerably more than the average. In only five cases was operation performed when the metabolic rate was more than plus 50 per cent. In general, it may be said that primary thyroidectomy should not be performed when the rate is above this figure.

Perhaps the most remarkable feature in the convalescence of these patients was the change in their mental attitude. Exophthalmic goiter affects the emotional system in various ways. Some patients tend to cry at the slightest provocation, others are irritable, high strung, and easily upset. After a few days' treatment these tendencies disappear and the patients are again cheerful, confident, and co-operative.

We continue to prepare all our patients with digitalis; 30 drops of the tincture are given three times a day for 3 days. When the heart action is very violent, an ice bag to the heart is still used for short periods. These measures are not so necessary since iodine has come into use, but there have been cases in which we have been thankful for the reserve supply of digitalis for the heart to fall back on.

OPERATION

Among the factors other than the use of iodine which have tended to lower the surgical mortality of exophthalmic goiter are the perfection of operative team work and the developments in the field of anæsthesia. Every patient in this series, with the exception of a 9-year-old boy, received only the morphine-scopolamine-novocain form of anæsthesia. Obviously it would be impossible to use local anæsthesia in such a high percentage of cases if it were not for the remarkable, quieting influence of the iodine. Patients are no longer brought to the operating room in a state of fear and trembling, and the surgeon has little to fear of the dreaded hyperthyroid reactions formerly attendant upon such operations.

Occasionally, however, an operation may prove technically so difficult as to tax the skill and the ability of the surgical team to carry it to a success-

ful completion. In long-standing cases in which the gland has become extremely vascular and friable, or when the period of preparation has not been sufficient, the operation may prove as difficult and as tedious as if previous ligations had been performed. Not only has the use of iodine simplified the problem of the surgeon by eliminating the factor of hyperthyroid reaction, but it has made the operation itself much easier. Except in the instances above mentioned, the gland is found to be less vascular and less friable, decreasing the tendency to hæmorrhage and facilitating removal. As a rule the forceps may be applied securely without aimlessly crushing the tissues. As a result of the patients' improved condition, the factor of time is no longer so important. It was possible to complete all these operations in one stage and by working more slowly and carefully to remove more of the gland. When I hear surgeons state that they perform a complete thyroidectomy, removing the entire gland, I marvel that they do so successfully without injuring the recurrent laryngeal nerve or the parathyroids. We endeavor to remove all but a small strip of the gland on the posterior border sufficient to guard against these complications. We believe that in order to insure the best prognosis as much of the gland as is possible should be removed. During the past 4 years we have had three recurrences of exophthalmic goiter; two of these cases were difficult and hurried operations because the patients were not prepared with iodine. Although the element of time is not as important as formerly, still unnecessary delay should be avoided. To perfect our team work we endeavor to standardize the steps of the operation so that each member of the operating team may anticipate every move. This has eliminated all talking and unnecessary noise and confusion. The surgeon does not stop to apply forceps but depends upon his assistant for this step which is a factor of considerable time saving.

We usually divide the muscles, preferring the better exposure to the slight delay occasioned by reuniting them. Finding the proper plane of cleavage so as to separate the capsule, ligating and dividing the lateral veins at once so as to avoid hæmorrhage, and then clamping and dividing the superior pole so as to mobilize the gland are important surgical procedures. We always resect and suture the right lobe, thus completing this stage of the operation and permitting the field to be cleaned up before proceeding to the isthmus and left lobe. All wounds are drained with a small rubber tube which is removed in 24 hours.

POSTOPERATIVE CARE

The advantage of local anæsthesia is that patients are awake and co-operative when returned to bed. There is no vomiting or aspiration of mucus. The room should be warm and if there is any indication of tracheitis, continuous vapor of steam benzoin should be in circulation. The administration of iodine, 1 drop to a teaspoonful of water, is started at once. Ten drops are given every half hour for six doses and four thereafter until the following morning. Each day the dosage is decreased 10 drops. For every 500 cubic centimeters of saline solution 10 drops of Lugol's solution is given by proctoclysis. Morphine or codine are used freely and, except when taking medication, the patient is encouraged to sleep as much as possible for 48 hours. If possible patients should be in private rooms so that their rest may not be disturbed.

POSTOPERATIVE COMPLICATIONS

Certain complications are bound to occur in spite of every precaution. In our early experience there were several severe reactions following operation and we still see these occasionally because of some error in preparation or after-care. The only fatality in this series of cases occurred in a patient who failed to receive iodine for 10 hours following operation due to a misunderstanding. Usually the reaction is most severe on the day after operation. As a rule, the pulse and temperature may be controlled perfectly with additional iodine. In some cases we give digifolin hypodermically as an additional safeguard.

Tracheitis is an annoying complication and may occur in spite of every precaution at the time of operation. As pointed out by Crile, the trachea should never be entirely bared but should remain covered by a thin layer of tissue. In spite of this, tracheitis may occur when the operation has been technically difficult necessitating some traction on the trachea. Steam inhalations, atropine, and sedatives are efficient remedies.

Postoperative hæmorrhage may occur about once in every hundred cases. If the patient is asked to cough at the completion of the resection of the gland, any small undetected bleeding vessels may be seen and the field made dry. After operation the nurse should be advised to watch for increasing dyspnœa, acceleration of the pulse, restlessness, swelling of the neck, and cyanosis. Intelligence and prompt action may save many lives.

The use of local anæsthesia, the maintenance of a dry operating field, and the avoidance of haste will decrease the chance of injury to the posterior

A REVIEW OF 120 PRIMARY THYROIDECTOMIES FOR EXOPHTHALMIC GOITER

Case	Sex and age	Basal metabolic rate: On admission	Basal metabolic rate: After Lugol's	Basal metabolic rate: On discharge	Weight loss	Wt. gain 1–24 mos. postop.	Pulse on admission	Pulse on discharge	Result
37193	F38	+29	+17	+9	15	30	118	72	Cured
37225	F49	....	+25	+5	12	12	90	80	Cured
32424	M23	+20	+16	+5	10	18	92	77	Cured
37680	M28	+17	+14	−5	28	30	83	72	Cured
34792	F46	+47	+27	+9	7	28	105	72	Cured
39010	F27	+20	+12	−4	10	12	90	65	Cured
31443	F	+52	+21	−7	18	20	94	72	Cured
39042	F27	+47	+30	+9	20	24	126	68	Improved
39392	F26	+34	+18	−5	21	18	113	76	Cured
37776	F50	+41	+24	+15	20	25	106	85	Cured
39882	F30	+40	+34	+9	24	8	105	72	Cured
39028	F31	+64	+28	+2	24	25	117	72	Cured
40074	F30	+38	+18	+5	7	17	80	88	Cured
40341	M24	+30	+14	−2	15	15	80	80	Cured
40648	F18	+24	+14	−1	20	25	88	72	Cured
41120	F27	+54	+32	+2	8	9	90	68	Cured
41171	F20	+48	+40	+5	20	30	130	79	Cured
41214	F31	+61	+40	+7	22	29	114	80	Cured
34617	F49	+32	+24	+1	30	35	110	80	Cured
41412	F	+24	+17	−1	10	26	132	72	Cured
41549	M31	+50	+31	+10	40	45	116	74	Cured
41864	F30	+44	+24	+12	5	15	94	72	Cured
41877	F48	+57	+37	+10	31	35	112	72	Cured
40953	F31	+48	+36	+19	19	19	130	72	Cured
42745	F40	+54	+34	+13	21	26	102	72	Cured
26214	F52	+48	+30	−11	23	25	117	85	Cured
42900	F49	+52	+44	+1	17	19	119	78	Cured
39161	F42	+44	+29	+8	44	14	98	90	Cured
43079	F19	+34	+25	+9	5	15	102	72	Cured
43018	F39	+54	+41	+6	6	3	116	70	Cured
43281	F38	+49	+31	+5	52	50	106	72	Cured
43836	F24	+56	+36	+10	41	35	102	72	Cured
44243	F38	+68	+44	....	15	33	118	72	Cured
44247	F37	+29	+19	−5	8	12	91	80	Cured
44261	F27	+55	+38	....	25	29	103	80	Cured
44129	F18	+57	+33	+9	38	45	160	95	Cured
44277	F42	+50	+34	−4	30	42	116	72	Cured
44301	F17	+44	+30	+2	17	27	141	76	Cured
44434	F20	+42	+28	+9	4	10	97	72	Cured
44345	F38	+22	+11	+2	24	25	101	84	Greatly improved
44372	F48	+54	+47	+2	20	55	100	72	Cured
44501	F41	+48	....	+1	20	35	110	78	Cured
20255	F35	+29	+18	....	14	20	108	72	Cured
44680	F47	+60	+41	c	35	39	102	72	Cured
47111	F30	+34	+25	+3	3	1	96	76	Cured
40132	F35	+39	+25	+5	13	21	113	80	Cured
47030	F39	+46	+23	−2	7	10	106	72	Cured
46777	F50	+68	+45	+6	45	20	116	73	Cured
46868	F63	+49	+25	+4	50	10	112	80	Improved
46720	F58	+52	+38	+3	25	10	116	84	Cured
46670	F23	+38	+32	+3	7	12	106	90	Cured
46694	F42	+48	+25	....	30	23	95	82	Greatly improved
41651	F42	+58	+42	+11	45	20	127	78	Cured
46489	F50	+83	+69	+12	27	25	96	72	Cured
45255	F38	+52	+37	−4	16	17	130	88	Cured
46340	F60	+38	+18	−7	23	15	113	85	Cured
46230	M49	+41	+30	+18	15	30	92	64	Cured
45384	F55	+68	+42	+5	56	35	116	74	Cured
46113	F70	+44	+38	−3	17	18	120	65	Cured
45985	F56	+63	+41	+19	36	28	122	82	Cured
45882	F18	+41	+25	+5	35	18	130	85	Improved
45703	F28	+42	....	+2	26	27	108	72	Cured
45308	F45	+42	+18	+12	38	2	136	90	Improved
45466	M9	+19	+33	+19	14	16	126	80	Cured
45428	F52	+67	+39	+16	50	47	106	72	Cured
45454	F16	+37	+21	+2	0	8	109	96	Greatly improved
44772	F28	+31	+17	+3	22	14	103	100	Cured
44989	F56	+55	+34	−6	36	14	110	90	Greatly improved
44641	F49	+45	+31	+9	29	30	112	90	Cured
45101	F22	+22	....	+10	17	20	84	72	Cured
44909	F46	+72	+40	+2	49	24	134	84	Improved
44815	F37	+40	+24	0	8	11	120	72	Cured
45117	M44	+38	+18	+4	17	37	84	72	Cured
45240	F35	+65	+42	+5	25	13	122	84	Cured
45126	F18	+42	+28	−4	5	18	111	72	Cured
45115	F20	+58	+34	−7	22	35	140	72	Improved
45344	F40	+68	+42	+8	45	40	130	82	Cured
45292	F21	+42	+25	−2	15	34	102	80	Cured
45384	F40	+72	+51	+5	50	35	142	74	Cured
45246	F42	+65	+41	+11	52	22	132	102	Cured
45336	F45	+51	+36	+1	36	31	93	80	Cured
45250	F29	+65	+56	+17	17	13	100	..	Cured
44447	F45	+47	+27	+3	19	27	110	72	Improved
45146	M39	+74	+58	+5	36	38	122	74	Cured
42625	M50	+30	+21	0	30	25	119	68	Cured
42806	F36	+49	+32	−5	49	42	130	72	Cured
42208	M32	+34	+16	+8	26	30	88	72	Cured
40653	F31	+57	+30	−2	17	13	119	112	Improved
41825	F16	+27	+17	+5	15	30	90	79	Cured
44047	F39	+50	+35	−7	0	6	124	75	Cured
47161	F32	+74	+62	+7	38	15	117	73	Greatly improved
45521	F34	+34	+14	0	20	7	99	79	Greatly improved
47306	F48	+68	+30	....	34	20	101	68	Greatly improved
47231	F47	+51	+21	−6	10	..	101	68	Greatly improved
47301	F16	+54	+31	0	5	17	120	90	Cured
47470	F53	+69	+49	+20	44	30	122	75	Cured
47413	F16	+55	+35	+5	5	20	140	75	Cured
47837	F35	+44	+30	+4	7	22	106	90	Cured
47803	F38	+64	+41	−11	18	22	110	67	Cured
47373	F58	+52	+32	+7	20	15	96	64	Improved
47652	F50	+77	+40	+5	40	19	110	60	Cured
47884	F48	+69	+42	+7	20	12	123	78	Greatly improved
47883	M32	+65	+45	....	22	16	110	72	Greatly improved
47626	F68	+31	+26	0	40	22	111	78	Cured
47943	F58	+36	+36	+4	28	8	140	63	Greatly improved
37753	F40	+82	+69	+29	44	12	127	77	Greatly improved
47982	F31	+44	+29	+5	0	7	109	80	Greatly improved
48134	F34	+29	+19	+9	0	7	100	82	Greatly improved
48102	F34	+44	+24	−13	4	8	112	62	Greatly improved
38c33	F21	+65	+38	....	20	..	89	..	Cured
48189	F38	+44	+24	+10	18	7	91	81	Improved
48094	M56	+59	+39	+20	40	32	82	80	Greatly improved
48200	F21	+80	+49	+31	35	22	81	81	Greatly improved
48432	F22	+64	+30	+2	24	4	132	64	Greatly improved
30074	F36	+84	+30	....	..	35	120	..	Greatly improved
48653	F28	+67	+47	....	8	..	150	..	Greatly improved
30854	F22	+85	+65	....	20	..	110	..	Greatly improved
48233	M48	+108	+84	....	40	..	107	..	Greatly improved
48114	F43	+94	+63	....	8	..	140	..	Greatly improved

recurrent laryngeal nerve. No surgeon who has performed a considerable number of thyroidectomies has escaped this unfortunate complication. Injury of only one nerve is usually compensated for in a few weeks or months, but a bilateral abductor paralysis may necessitate the permanent use of a tracheotomy tube or even lead to fatal consequences. There were no cases in which both nerves were injured in this series, but in three instances there was temporary involvement of one nerve. Whether this was due to trauma, œdema, or the formation of scar tissue, it was impossible to say.

Postoperative pneumonia occurred in only one instance. The use of local anæsthesia and the avoidance of nerve injury have largely eliminated this complication.

In this series there were no cases of postoperative tetany. In a very recent case, there is a possibility of postoperative myxœdema developing. A single metabolism test shows a rate of minus 20 per cent and as the patient has been gaining weight rapidly she has been put on thyroid extract. There was no postoperative infection in this case and there is a possibility that thyroiditis was present at the time of operation or has since occurred. No more of the gland than usual was removed.

PROGNOSIS

The time that has elapsed since operation is too short to allow one to say that these cases are permanently cured. The fact remains, however, that so far as the patients themselves are concerned 92 per cent report themselves as cured or greatly improved. These reports are confirmed in most instances by our own clinical examination or that of the family physician. Practically every patient is performing his normal duties except where certain restrictions are imposed. Although only a few weeks or months have elapsed since operation in some cases, there has been an average gain in weight of 21 pounds. The pulse rate has dropped on the average from 120 to 79 beats per minute. This series represents but a small number of the cases of exophthalmic goiter that are being successfully treated in this country today by the combined efforts of the internist and surgeon. Those who have opposed surgical measures on the grounds that long periods of hospitalization are required, that the surgical mortality is high, or that the results of operation are not satisfactory should give consideration to these facts.

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EFFECT OF STERILIZATION ON HORSEHAIR

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A STUDY was made to determine the effect of sterilization on the tensile strength of horsehair. (See tabulation.) Equal lengths of horsehair were grasped at either end by mosquito forceps, the jaws of which were padded to protect the hair. The hair was suspended and a basket in which weights were placed was attached to the free end of the hair. Starting with weights of small denominations, additional weights were added until the point was reached where the hair broke.

Seven methods of sterilization were tried. Our first tests showed that autoclaving was least injurious to the hair, while boiling damaged it greatly. The chemical methods had an intermediate effect. As autoclaving or boiling is a quick method of sterilizing the hair, we again

Fig. 1. Photomicrograph of a horsehair treated to remove some of the pigment and dirt, showing the presence of scales. The scales are directed toward the distal or small end of the hair and are very numerous. Those shown here are all that were gotten in one high power focus.

repeated tests using these two methods. The tabulations were again conclusive that boiling the hair was injurious to it. Hair which had been boiled for 20 minutes broke repeatedly at from 12 to 15 ounces of pull, as compared with untreated samples which resisted a pull of 22 to 30 ounces. We also noted that boiling had in some way affected the elasticity of the hair. Boiled hair when an initial weight was applied would stretch from 8 to 12 inches and retract for about 2 inches when the weight was removed. That this stretching represented a weakening of the hair was substantiated by tests on autoclaved hair. These samples resisted stretching to any great extent until the maximum load was approached, that is, just before the hair would break, it would stretch. Hair which had been autoclaved 20 minutes, like the untreated hair, resisted a pull of from 22 to 30 ounces. In other words, autoclaving had no appreciable effect on the tensile strength of the hair.

We had noticed that hair would draw easily through tissues in one direction and pull when the hair was reversed. A possible explanation of this observation was made in the laboratory. Hair treated so as to remove some of the pigment revealed an imbrication of the scales of the hair cuticle. The imbricated scales are directed away from the root of the hair. In threading the hair for use, it is therefore advisable to thread the root end. The root end is larger and is easily determined unless the hair is cut in short lengths.

It is desirable to have the hair as pliable as possible while working with it, because pliable hair can be drawn through the tissues more easily and does not break so readily. A number of methods of treating the hair to make it pliable were tried, such as soaking it in glycerine, lanolin, olive oil, and saline solution, but none of these was satisfactory. However, keeping it in hot water until it is handed to the operator has been found very satisfactory.

Since autoclaving is the most satisfactory form of sterilization, because of the ease with which it can be done, the dependence that can be put on it for killing all organisms, and the fact that it does the least damage to the hair, it does not seem necessary to use any other or seek any other plan of sterilization.

THE EFFECT OF STERILIZATION OF HORSEHAIR[1]

	Sample number	Length in feet	Broke at ounces
1. Washed hair	1	2	22.5
	2	2	23
	3	2	31
2. Autoclaved, 15-5 pounds for 20 minutes	4	2	24
	5	2	24
	6	2	24
3. Bichloride of mercury, 1:1000 for 10 hours	7	2	18.5
	8	2	18
4. Carbolic acid 5 per cent with hydrochloric acid ½ per cent for 2 hours	9	2	19.5
	10	2	16
	11	2	16
5. Bichloride 1:1000, 12 hours, then autoclaved for 20 minutes	12	2	16
	13	2	16
6. Autoclaved 20 minutes in lanolin	14	2	16
	15	2	16.5
7. Boiled for 20 minutes	16	2	16.5
	17	2	14
	18	2	12
8. Dry heat (burned hair)	..	.	....
SUBSEQUENT TESTS			
Boiled for 20 minutes	19	2	12
	20	2	14
	21	2	14
	22	2	15
	23	2	18
Autoclaved for 20 minutes	24	2	22
	25	2	22.5
	26	2	25
	27	2	30

[1] Cultures following sterilization for both aerobic and anaerobic organisms were negative.

CORRESPONDENCE

THE DANGER OF INCOMPLETE REMOVAL OF SMALL AND APPARENTLY INNOCENT LESIONS

To the Editor.—Permit me to address my colleagues among the operating surgeons, all of whom must read this journal, in regard to a very vital and fundamental fact in relation to the complete removal of early, relatively small, and clinically innocent tumors.

It has always been my rule—and I believe I should give Halsted of Johns Hopkins the credit of having formulated it—to remove completely any local growth with sufficient margin so that if the microscopic study shows malignancy, no further operation will be necessary. Should such a local operation be mutilating, then the operator should at once expose the tumor and ascertain its nature by means of a frozen section and plan the operation accordingly. I have had in mind this letter for 2 or 3 years. The problem was, how to put this message over.

I have been teaching this rule and have given the evidence for years. I have rarely written an article without mentioning it, but apparently the message is either not understood, or has not reached many of my own friends and my own students. Let me first give two cases as illustrations.

CASE 1. This morning I looked at a section through the microscope and interpreted the cellular picture as chondrosarcoma. There seemed to be no question as to malignancy. I knew such a picture could be present in a small or large tumor, just as a basal-cell cancer looks the same whether in a minute subepidermal nodule, or as a part of a huge infiltrating rodent ulcer. The letter from the surgeon, who had referred the specimen to me, gave the usual information: There was a small tumor to be felt in the region of the knee joint. It had been observed by the patient for a few months. It did not interfere with joint function. It was painless. It did not show in the X-ray. It did not involve bone. At the operation under local anæsthesia it seemed encapsulated; it was slightly adherent to the fascia, but not to the synovial membrane. The clinical history, palpation, and the appearance at exploration impressed the operator that it was a benign tumor. It was removed by a combination of blunt dissection, "shelling out," and enucleation. No attempt was made to give the border or capsule a wide margin. It was removed as one would a lipoma or a wen in the scalp, or an encapsulated parotid tumor, or an atheromatous cyst. The operator describes its gross appearance as white like a fibroma with colored areas like a xanthoma, and as having the consistency of cartilage. The wound was closed. To his surprise, chagrin, and consternation, his pathologist, in a *few* days, reported it to be sarcomatous. The surgeon was anxious to know what to do.

CASE 2. There was a recent patient of mine with a wen on the scalp and a prolapse of the uterus. Naturally, she wanted both attended to at once. I refused. When she was fully convalescent from the plastic operation, I removed the wen from the scalp with the cautery, with a margin sufficient for a malignant tumor. The little tumor was clinically benign; it was smaller than a 25-cent piece. It had been present for years. The patient had never noticed any recent growth. There had been no pain or tenderness. But my records showed that 5 per cent of clinically benign dermoids are cancer and if these are enucleated (shelled out) there is local recurrence, and usually death from cancer. If they are completely removed in the first instance the results are just the same as after the removal of the benign dermoid cyst. In this instance I mention (Case 2) the wen proved to be a solid cancer, and the frozen section showed a carcinoma spinocellulare. You can enucleate a wen or a dermoid without danger, but you cannot the cancer in a dermoid, and there is no way of telling the early stage of cancer in a dermoid.

I can give numerous examples similar to Case 1, and they are on the increase. In Halsted's clinic, before 1900, these benign lesions of the skin and oral cavity averaged about 3 per cent. Surgeons were trained in the observation of the fully developed cancer or benign tumor. Since 1920, in my own clinic, these benign lesions, or these tumors in the benign stage have increased from 3 to 60 per cent. Operators have not trained themselves for these new conditions. Hardly two weeks pass that some surgeon or pathologist does not send me the sections or the tissue and the records of an observation similar to that described in Case 1, asking what to do. In my own clinic every week and often now a number of times a week, I have the extreme satisfaction of an experience similar to that described in Case 2. I have removed an apparently innocent tumor, I have followed the rule of the wide margin with or without the cautery, and then the section has revealed microscopic cancer. In all instances the local operation has been done. In some instances it may be necessary to remove the neighboring lymphatic glands, as in cancer of the lower lip.

I wish to emphasize this again: When the complete removal would be mutilating, then ascertain at once the nature of the local growth. This can be done by cutting out a piece with the cautery and making a frozen section at once.

Where frozen sections were rare occurrences in the operating room they are becoming common occurrences. Surgeons and pathologists in many hospitals of this country are now preparing them-

selves for this new diagnostic demand, the frozen section apparatus, the technician, the pathologist, and the different types of cauteries, which must be made as accessible to the operating room as the anæsthetist and the operator and his assistants. Unless the surgeon is trained, he will not be prepared for the making and interpreting of this frozen section.

As we train the public, as we give them correct information, the percentage of these cases will be on the increase. To meet the demands of the larger group, the complete excision of the local growth and the later microscopic diagnosis will not be difficult. This requires no new training on the part of the surgeon. It is simply a question of giving up bad habits and forming new ones. However, the second requirement presents difficulties, because at the present time in the majority of clinics the cases demanding immediate frozen sections are unusual. The technique of the method of polychrome methylene blue staining is generally not well carried out. Many, if not the majority, of pathologists are not training themselves to meet this demand.

When the local lesion can be completely removed without mutilation, and this local removal is well done, there is no danger in a late pathological report. The tissue may be sent to any laboratory at any distance without danger to the patient. But for the second group, there must be the apparatus, the technician to make and stain the frozen section, and the pathologist to examine it. Unless the tissues of the first group are studied in the same locality, it will be impossible to train such a pathologist for the emergency. In this country, in smaller towns and in smaller hospitals, the tendency is to have not sufficiently trained pathologists in each hospital, rather than one well-trained pathologist for all the hospitals. It is time now for the College and the surgeons to take up this problem. In every operating room in this country either these operations requiring frozen-section diagnosis should not be done and referred elsewhere, or that hospital or that group of hospitals in one locality should prepare for this frozen-section diagnosis. Incomplete operation and delayed pathological diagnosis are dangers to the American public, and they are no longer necessary evils. This equipment should be part of the minimum requirements of every hospital in which operations of this character are performed.

In the surgical pathological laboratory[1] of the Johns Hopkins Hospital 33 per cent of all sarcomata come under observation as recurrent tumors. In 75 per cent of these recurrent tumors the primary lesion was small, diagnosed benign and incompletely removed by one method or another, and, as stated in the first instance in this letter, the number of cases of incomplete removal of small and clinically innocent tumors is on the increase, and the per cent of operations without the protection of an immediate frozen-section diagnosis is greatly on the increase. We must keep pace with the enlightened public.

JOSEPH C. BLOODGOOD.

Baltimore, Maryland.

[1] Arch. Surg., 1925, viii, 802.

COMBINED INTRA-UTERINE AND EXTRA-UTERINE PREGNANCY

To the Editor.—In the July issue of SURGERY, GYNECOLOGY AND OBSTETRICS, Dr. Emil Novak speaks of the extreme rarity of combined intra- and extra-uterine pregnancy. Therefore, I desire to add another case to his collection of 278 cases.

Mary McM., aged 36, white, had had 7 children, 5 of whom were living, and 5 miscarriages. Menstrual periods were normal and lasted 4 to 5 days. The last appeared in October, 1913. On February 8, 1914, having a bad cold, she had a violent coughing spell, which gave rise to agonizing pains in the lumbosacral region and she fell to the floor. She said that the pains simulated those experienced during former labors but were more pronounced. Rectal tenesmus and a slight bloody discharge from the vagina were noted. February 21, 1914, she entered the hospital after being bedfast two weeks. The abdomen was distended and tender; the uterus enlarged, somewhat softened, and retroverted; the fornices were distended and very sensitive; the pulse was 100 and temperature slightly elevated. On February 22 laparotomy was performed and the abdomen found full of blood. The right tube, ovary, a 4 months' fetus, and the placenta which was adherent to the broad ligament, were removed. The uterus had the appearance of containing a normal pregnancy. Convalescence was uninterrupted and she left the hospital on the twenty-first day. She returned to her home in the southern part of the state and on August 14, 1914, was delivered by Dr. McManigal of a full term baby girl. Menstruation occurred twice after the daughter was born and then ceased.

EARL M. GILLIAM, M.D.

Columbus, Ohio.

UNTREATED CANCER OF THE BREAST
A CORRECTION

In the article by Dr. Ernest M. Daland, on "Untreated Cancer of the Breast," p. 264, February, 1927, an error was made in that the first curve in Figure 1 (duration of life from onset) was incorrectly labeled. Curve A should have been labeled "100 Untreated Cases."

THE EDITOR

EDITORIALS

SURGERY, GYNECOLOGY AND OBSTETRICS

FRANKLIN H. MARTIN, M.D.....Managing Editor
ALLEN B. KANAVEL, M.D.....Associate Editor

WILLIAM J. MAYO, M.D.....Chief of Editorial Staff

MARCH, 1927

INDEX TO VOLUMES I–XL

IN June, 1925, it was announced that an Index of Volumes I to XL of SURGERY, GYNECOLOGY AND OBSTETRICS was in the course of preparation, and in connection with that announcement some of the outstanding events in the organization and early history of the Journal were briefly reviewed. It was pointed out that in the forty volumes which were brought to a close with that issue upward of five thousand original contributions had appeared among which were reports of experimental work and of clinical results from eminent and able workers in every part of the world.

Now after twenty months of detailed labor, the index volume is completed. It is divided into two parts, subjects and authors. The subject index is carefully indexed and cross-indexed. It provides ready access to all the original communications which have appeared in the Journal since its beginning in 1905 and to the collective reviews which have appeared in the INTERNATIONAL ABSTRACT OF SURGERY since 1913.

Because it is an index to a single journal it has been possible to index the material more thoroughly than is usual in general indices, and thus make available specific information. Not only have articles as a whole been considered, but details of unusual value, that might otherwise be lost, have been entered under specific headings. For instance, although each case report has not been indexed, unusual cases have been cited under appropriate headings that may not have been indicated by the main subject of the article in which they were reported.

In classification, an anatomical scheme has been used primarily. Added entries under pathological and other headings have been used when required. Tumors, for example, which could be classified by type, have been listed both under anatomical and pathological terms. Melanosarcoma of the liver is listed under liver, sarcoma and melanosarcoma. If a lesion involving several organs is described, even though the organs be part of the same system, the article is cited under each organ, and if the pathological lesion is of interest aside from the region or organ affected the article will also be found listed under the lesion itself.

Cross references, freely used, direct the searcher from synonymous terms to the one selected as the key word, and from comprehensive to specific terms. In the choice of terms the latest practice has been followed so far as possible. In all it has required approximately 17,000 entries to cover the forty volumes.

The index will make a complete, or even a partial file of SURGERY, GYNECOLOGY AND OBSTETRICS an invaluable encyclopedic tool for the research worker in his own library. Through it the surgical research and practice

of the many distinguished contributors of the past twenty years are made instantly available; while the excellent bibliographies accompanying most of the papers open many sources of material for individual study.

CO-OPERATION IN THE TREATMENT OF NEOPLASTIC DISEASE

OUR most effective weapons to combat the destructive processes of neoplastic disease are either some type of surgical, radiological (radium and roentgen rays), or surgical diathermic methods, used singly or in combination. When one of these is used singly, it has definite limitations, but when employed in combination the scope is greatly increased.

To point the way or indicate just what should be done in a given case is not a simple task. As yet, the etiology of neoplastic processes is unknown but careful observation has afforded valuable data. Years ago, we were limited to the one recognized method, surgical removal. When this was impossible, the case was usually considered hopeless. Experience has established the superiority of radium, roentgen rays, and electrothermic methods in certain fields, but treatment would be less complicated and good results more certain if all cases could be seen early in the disease. As yet very few early cases are seen, so our problem remains complex.

Today there is a large group of patients whose health is either threatened or already undermined by some type of neoplastic disease; they are beyond the operable stage and yet worthy of our best consideration, since in apparently the most hopeless cases a most brilliant result may sometimes attend the proper method of attack. For better results it is essential to study the patient thoroughly, decide on the probable clinical diagnosis and then group the case as early, borderline, or late. The differences of treatment in the separate groups are rather clear-cut. If lesions are superficial or semi-superficial, that is, occurring in the skin, mouth, rectum, vagina, and so forth, where palpation and inspection can be carried out, classification is fairly simple. If the primary lesion is more deeply situated, however, it is necessary to expose the tumor by recognized surgical procedures. To be sure, operation should be undertaken immediately in the early case. Aside from the benefit to be derived through wide excision of the tumor, the specimen furnishes valuable material for study, and the correlation of the pathological and clinical findings will greatly assist in the decision as to diagnosis, treatment, and prognosis. The pathologist should give a complete report including the degree of malignancy encountered. His opinion helps greatly in estimating the prognosis and determining the most effective postoperative course to follow. Microscopic methods give the most reliable information yet devised respecting the grade of malignancy present in any tumor, and this information serves as a guide to the surgeon and radiotherapist in their immediate procedures. Broders has definitely shown that, when the malignancy is graded 1 or 2, wide surgical removal is the most effective procedure; however, no matter how radical the operation when the malignancy is graded 3 or 4, it will prove ineffective in a very large percentage of the cases.

The treatment of the borderline and inoperable cases has afforded useful information in the management of the early cases. For all tumors graded 3 and 4, postoperative irradiation is indicated; the tumors graded 1 and 2 may be treated with the expectation that the operative field will be favorably affected. The institution of irradiation in these less

malignant types depends on the findings at operation, the site of the lesion, and the type of operation performed. Should there be any doubt as to the possibility of the tumor having perforated its capsule, of its being fixed at any point, of whether or not all the malignant tissue has been removed, or of the presence of enlarged regional lymph nodes, postoperative treatment should be carried out irrespective of the grade of malignancy.

The superficial malignant lesions in the borderline cases in general should be given the full pre-operative treatment followed by an interval sufficiently long to permit all effects on the tissue to disappear. When the maximal benefit has occurred, which is usually in from 6 to 12 weeks, surgical procedures should be instituted. The findings at operation should indicate whether or not postoperative treatment is necessary. In cases in which operation is performed the operation should not be pushed to completion at a great risk, since it may be better to curtail it and institute radium and roentgen-ray treatment.

In the late cases a combination of radium and roentgen-ray treatment, and electrothermic methods give the most satisfactory results, but in order to facilitate the thorough application of these procedures surgery is sometimes necessary. Excision of the bulk of the mass, drainage by colostomy, suprapubic cystostomy, decompression, etc., are the methods chosen.

Following the foregoing initial methods, a follow-up check on the case is most essential since the patient cannot be trusted to return for observation at the proper time. If treatment is instituted early, the utmost may be expected; if instituted late, palliation alone may be expected.

Hospital and clinical facilities should be so organized that the patient may be given the most effective care. Should it be impossible to have all facilities in one institution then arrangements should be made with other institutions for the employment of combined methods of surgery, radium and roentgen rays, and electrotherapy.

HARRY H. BOWING, M.D.

MEMOIR—E. WYLLYS ANDREWS

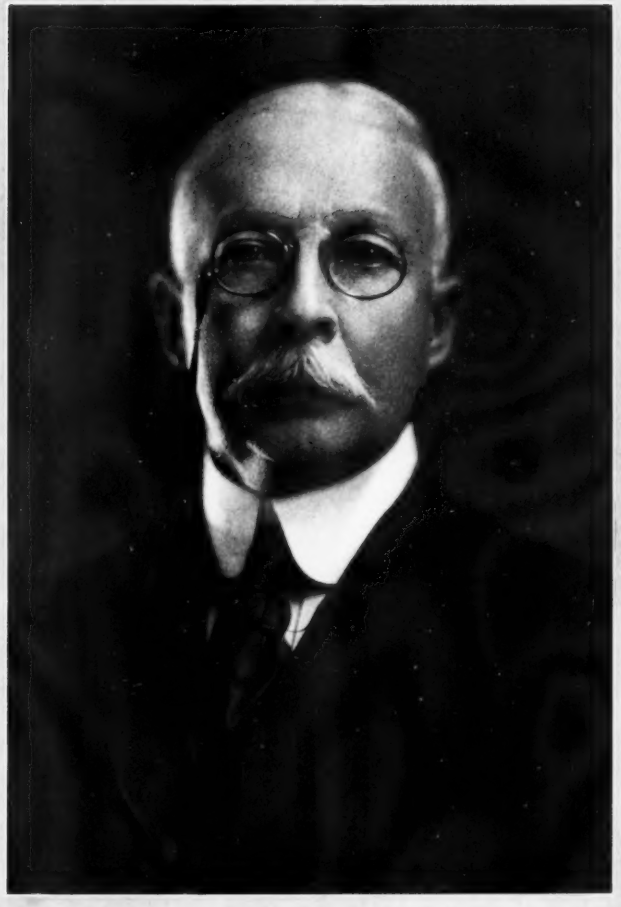
1856–1927

IT is with profound regret that SURGERY, GYNECOLOGY AND OBSTETRICS announces the death of E. Wyllys Andrews, one of the founders of this journal and one of its editors from its inception. His kindly, sympathetic interest and never failing response to demands upon his time in the interests of the journal have been of inestimable value. The loss of Dr. Andrews is especially felt since his death is the third break in our ranks in the past year. The loyalty and support of these men has been one of the outstanding factors in the development of the journal.

Dr. L. L. McArthur, for many years a personal friend and hospital associate of Dr. Andrews, and Dr. Kellogg Speed, at one time an assistant for many years, present short memorials of our distinguished co-worker.

SOMEONE has said, "To know a man, one must winter and summer with him." In this instance, I have done just that for 40 years, and yet I do not feel that I knew Dr. Andrews intimately. Years ago, it was my privilege to urge Dr. Wyllys Andrews' appointment as my colleague on the surgical staff of Michael Reese Hospital. Never, in all those years, was there ever an unkind word, act, or look between us, nor the slightest friction. Here then is the outstanding picture of his character: the total lack of all quarrelsomeness, opposition, and almost too much of the "turn the other cheek" tendency to please his unregenerate confrères. Never have I known him to say an unkind thing of one of his associates, no matter what the provocation: if he could not praise, he said nothing. So modest, retiring, quiet a comrade that one little suspected the wealth of learning or the broadness of vision until some occasion invited his expression of opinion, when the most enlightening portrayal of the situation under consideration and the practical simple plan for its control revealed it.

Like his father, he loved to spend his vacations in the wilds but little frequented by men, busying himself more with the study of geology, the flora and fauna of the spot, than bagging big game. Thus, annually he made trips into the wilds of Canada, the Georgian Bay, or the small islands of the Carribbean, absolutely happy behind a bellying sail, a beam wind, and a following sea.



E. Wyllys Andrews

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OF

Of him, his friend, Dr. Otto L. Schmidt, once said, "An unforgetable friend, gentle but firm in character, unselfish to the last degree, a beautiful mind perfectly balanced by a calm and placid philosophy that was ever just."

LEWIS L. McARTHUR.

PERENNIALLY come irreparable losses to our surgical profession. When the passing of one man deprives us of great teacher, technician, and scholar, we all must bow in reverence. Edward Wyllys Andrews of Chicago has gone.

Dr. Andrews was one of the founders of the American College of Surgeons and a believer in its aims and promising greatness. He was author of innumerable articles on various branches of surgery and a contributor to some of our best known textbooks. His greatest surgical bequest is his work on hernia. Starting at a relatively young age to study this common ailment he attempted to solve its many intricate problems. The result is his imbrication operation for inguinal hernia—a procedure known and practiced the world over, a radical cure for hernia based on sound anatomical principles, open to many variations for individual cases, and one which has withstood the test of time.

Dr. Andrews to the very last was an active member of the American Surgical Association, the Society of Clinical Surgery, the Western Surgical Association, the Chicago Surgical Society, the American College of Surgeons, and other organizations, many of which he had served in the capacity of president; he was Head Professor of Surgery, Northwestern University Medical School; formerly Surgeon-in-Chief, Cook County Hospital; and Attending Surgeon, St. Luke's and Michael Reese Hospitals. He was a competent Latin scholar and a real student of Shakespeare. His library was particularly rich in this latter subject. On his frequent visits to London he delighted in prowling around the haunts of Johnson and Shakespeare.

He was intensely human, considerate of those about him, punctual, always ready for a joke. Under no stress did he ever give way to temper; his technical surgery was a wonderful display of efficiency in action, for he never made an unnecessary or useless movement. While he seemed deliberate, so well did he control each purposeful action that his surgery was unusually rapid. His delicacy, his knowledge of anatomy, and his gentleness of all thought and action brought him constant successful results. In surgery of the stomach he was pre-eminent. He also loved mechanical things,—was never happier than when engaged in a technical discussion of internal combustion engines or various forms of marine power. His main diversion was yachting and camping, both in Florida and Canada.

It was the writer's privilege some years ago to dedicate a book to Dr. Andrews. The words of that dedication still ring true—"Gentleman, Master Surgeon, and Friend."

KELLOGG SPEED.

THE SURGEON'S LIBRARY

OLD MASTERPIECES IN SURGERY

By ALFRED BROWN, M.D., F.A.C.S., Omaha, Nebraska

GIROLAMO MERCURIALE (HIERONYMUS MERCURIALIS)

ITALY during the sixteenth century was a hotbed of war and political intrigue. Nevertheless the arts and sciences flourished and grew strong, mainly through the efforts of the family of the Medici—which had gained a position of power in Florence through Cosimo de Medici, called Pater Patriæ, who died in 1464. This family encouraged all the arts and among their protegés we find Raphael and Boticelli, the painters, Michelangelo and Pallajuolo, the sculptors, and also the surgeon Girolamo Mercuriale who appears to have become a favorite of a much later Cosimo, the first of the Medici to become a tyrant—Cosimo I who ruled Florence with a rod of iron from 1537 to 1574.

Mercuriale's name also recalls that of the Medici for he was born at Forli in 1530, being the son of a physician Giovanni Mercuriale. Forli was the home of Catherine Sforza, Countess of Forli, who married Giovanni de Medici and was the mother of Giovanni delle Bande Nere (The Black Band) who became the only soldier of the Medici family. Catherine's defense of the Castle of Forli is an epic in history, even though it failed. Mercuriale took up the study of medicine and philosophy, probably at Padua. He was particularly interested in the ancient writers for his works are nearly all criticisms or reviews of their works and there is little original clinical work shown. He also, judging from his later career, devoted some of his energy to politics, for it is inconceivable how anyone not a consummate politician, could have gained the high positions he held at this time when intrigue was at its zenith. He became a doctor of medicine and philosophy in 1555. On his return to his home he gained a great reputation and seven years later was entrusted with an important mission to Pope Pius IV, the friend and ally of the tyrant Cosimo I of Florence. This took him to Rome and gave him access to the great libraries where he could study the works of the ancient authors, not only from their recently printed works but also from the manuscript copies then extant. He remained in Rome for seven years working along these lines. His next position was more political than medical for he was sent to the Senate at Venice, but this did not last long and he was called to fill the chair of professor of practice of medicine at Padua. There his learning gained him a great reputation which spread outside Italy, for in 1573 he was called in consultation by the Emperor Maximilian II, for which service he was created a Knight. He remained as professor at Padua a little more than seventeen years and later held successively the professorships at Bologna and Pisa. Finally he resigned his position at Pisa and returned to his old home in Forli where he died in 1606.

Mercurialis wrote, or at least served as the inspiration for many books, for some that pass under his name were actually written by others. His *Variarum Lectionum in medicinæ scriptoribus et aliis* was first published in Venice in 1570. Later it was enlarged to six books and published in Paris in 1585 by Nicolas Nivellius.[1] It is astounding the amount of reading and research the book shows, for Mercurialis has contrasted the different views of ancient writers upon various topics and discusses critically their points of agreement and disagreement. As an example, one of his paragraphs is entitled "The Opinions of Aristotle and Strabo concerning the generation of animals in snow and fire collected and examined. The opinion of Aristotle amended." There is nothing mentioned in the book concerning modern authors or practitioners which alludes to them by name; but modern methods are often cited and contrasted to those of the ancients. In looking over the work, one should bear in mind that though Vesalius, Paré, and many others endeavored to overthrow ancient ideas and had in part succeeded, their methods were hammer and tongs insistence on their own ideas backed up by submitting their data to proof. Mercurialis, on the other hand, was the political compromiser and tries to show that though the ancients may at times appear to be wrong, yet they really meant the same thing. Still he did at times take sides and in no uncertain terms, and though a student of the ancients he differed from them in some ways, for he upheld the ideas of Brissot concerning bleeding which had caused such a furor because he (Brissot) disagreed with the ideas of the ancients, particularly the Arabians.

Mercurialis also wrote a work on *Gymnastics in Medicine* in which he stresses the importance of all forms of exercise on the general health. This subject had practically been forgotten up to his time but his great knowledge of the works of the ancients enabled him to resurrect their physical therapy and save it for future generations.

[1] Courtesy of the Library of the College of Medicine, University of Nebraska.

HIERONYMI

MERCVRIALIS

VARIARVM LECTIONVM, IN MEDICINÆ SCRIPTORIBVS ET ALIIS, LIBRI QVINque priores,

Ab auctore aucti & recogniti.

Quibus adiectus est liber sextus antea nunquam editus.

Cum Indicibus copiosissimis.

PARISIIS,

Apud Nicolaum Niuellium, via Iacobæa, ad insigne Columnarum.

M. D. LXXXV.

REVIEWS OF NEW BOOKS IN SURGERY

MORGAN[1] has compiled what he designates as a handbook of surgical electrotherapy for the use of practitioners and students. The object of the book, in the words of the author, "is to supply to the medical profession, in general, a statement of the value of the electrothermic methods, a short account of the means by which desiccation and coagulation are produced, and the manner of their application . . . to supply the inexperienced operator with sufficient information with which to make a beginning at least; to prove the advantages in certain cases of these methods over the older surgical procedures; and to indicate in what conditions each of these methods has its own particular value."

The fundamental principles governing the modern methods of utilizing high frequency currents are lucidly outlined in the first chapter. The difference between fulguration, electrodesiccation, and electrocoagulation, both in mode of production and effect on tissue, is discussed. The advantages of electrodesiccation and coagulation of accessible neoplasms, both benign and malignant, as compared with scalpel excision, are enumerated and a short description of the technique for the various procedures is given. No attempt is made to include specific clinical reports. The treatise deals in generalities throughout but should be useful as a primer for those unacquainted with this increasingly popular method of treatment. VINCENT J. O'CONOR.

THE sixth edition of Politzer's[2] textbook has appeared, and like the previous editions, it is a valuable book for the student, the general practitioner, and the otologist.

The material is authorative and is based on the extensive experience of a great clinician. The reviewer approaches such a volume with reverence, for it is one of the great classics. The thing to be regretted is that so little is drawn from American otological literature, so few American authorities being cited on subjects which have been extensively studied in this country. In a revised edition one would expect to find reference to the newest developments in the specialty. Such facts are obviously omitted and no mention made of the literature on otology which has had prominence during the past 20 years.

However, the translator is evidently making a determined effort to preserve the original text of the author. The book will continue to be a valuable reference volume and as such will retain a permanent place in the physician's and specialist's library.

As in the earlier editions the arrangement of material, the illustrations, particularly those of histological specimens, and the special sections, such as the one on deaf mutism, add much to the value of the work. F. J. NOVAK.

DR. JACKSON has written a book[3] on thyroid diseases which is short and simple. It is profusely illustrated, well printed, logically arranged, and presents the current ideas on the prevention of goiter by iodine and the cure of hyperthyroidism by thyroidectomy. The only serious criticism to be made is that these simple propositions are too briefly set forth and that important considerations will not be grasped by the reader who is not already familiar with this subject. The questions involved in the postoperative use of Lugol's solution, the preoperative use of iodine in iodine hyperthyroidism, the amount of thyroid tissue to be removed at thyroidectomy, and the iodine treatment of thyrotoxic crises which are of the greatest practical importance are passed over too rapidly. It is to the completeness with which the thyroid is removed that present-day surgery owes its success in the cure of hyperthyroidism.

The author regards toxic adenoma, iodine hyperthyroidism, and exophthalmic goiter as distinct thyroid diseases. This is a view which is now being seriously questioned.

The Tissot gas analysis method of metabolic rate measurement is recommended at length.

PAUL STARR.

TOLDT'S *Atlas of Human Anatomy*[4] presents no changes of subject matter over the 1919 edition and is probably sufficiently well known to the profession to need no introduction. It is purely an atlas and contains no descriptive text whatever, except that the translator has added the English equivalents to the continental Latin terminology. There are 1,505 illustrations. Those of the arteries, veins, and muscles are in colors. With this large number of pictures covering every structure in human anatomy and covering it well, the matter of expense of reproduction must necessarily be reflected in them, and it is to be regretted that such an excellent collection as is in Toldt's *Atlas* should not have been more pleasingly executed.

This edition of the book seems to be printed on a better grade of paper than the previous one and is issued this time in two volumes making it more convenient as well as much less expensive.

MICHAEL L. MASON.

[1] ELECTROTHERMIC METHODS (DESICCATION AND COAGULATION) IN THE TREATMENT OF NEOPLASTIC DISEASES. Designed as a Practical Handbook of Surgical Electrotherapy for the Use of Practitioners and Students. By J. Douglas Morgan, B.A., M.D. Philadelphia: F. A. Davis Company, 1926.

[2] POLITZER'S TEXTBOOK OF THE DISEASES OF THE EAR FOR STUDENTS AND PRACTITIONERS. Revised and largely rewritten by Milton J. Ballin, M.D., Ph.B. 6th ed. Philadelphia: Lea and Febiger, 1926.

[3] GOITER AND OTHER DISEASES OF THE THYROID GLAND. By Arnold S. Jackson, M.D. New York: Paul B. Hoeber, 1926.

[4] AN ATLAS OF HUMAN ANATOMY FOR STUDENTS AND PHYSICIANS. By Carl Toldt, M.D. Assisted by Professor Alois Dalla Rosa, M.D. Adapted to English and American and International Terminology by M. Eden Paul, M.D. (Brux.), M.R.C.S., L.R.C.P. New York: The Macmillan Company, 1926.

DR. EDWARD JACKSON began the review of the literature of ophthalmology in 1903 in the *Ophthalmic Year Book* which in 1918 was merged with other publications to form the *American Journal of Ophthalmology*. In this journal appear monthly the lists of current literature which form the basis of the bibliographic lists and the digests found in the year book.

Volume xxii[1] contains 315 pages with 9 illustrations. There are 32 chapters in each of which the bibliography is given first, followed by a digest of the literature in the bibliography. The authors' names appear alphabetically in the bibliography, but each name has a number which corresponds to the order in which the reference is mentioned in the digest. This is a great convenience. There is a 16-page index of authors and a 14-page index of subjects. There is also a list of books relating to ophthalmology, reviews of which have appeared during the last year.

This volume should be in the possession of every ophthalmologist who will want access to a compilation of recent literature. The editor and his associates have given of their best efforts and the result is worthy of great praise. VIRGIL WESCOTT.

EVERY medical man who served in the army during the Great War will find interesting pages without number in Dr. Chapin's story[2] of the American doctors who served during the war with the British on the western front. Those who are mentioned in its pages and whose story he has told so well will not cease to cherish it as a prized possession.

The author has suggested in Chapter iii that the services of the "Lost Legion" have not received sufficient recognition or acknowledgment. Of what constitutes recognition there may be some dispute, but after reading of the experiences of Dr. Chapin and his fellows one cannot help but feel that the thrill of adventure, the friendship of brave allies, and the consciousness of splendid work unselfishly done are greater rewards than parchments or medals.

TWO volumes by Hovelacque,[3] which have recently appeared, are devoted entirely to the gross anatomy of the cranial and spinal nerves and to the sympathetic nervous system. Many well drawn and accurate plates illustrate the text, which is brought to date by various references to the current literature. Most anatomies depend for their popularity and usefulness upon the quality and number of their illustrations. The loss of my third volume of Spalteholz will not be so keenly felt since I have received this work. LOYAL DAVIS.

IN the preface to his textbook[4] on human pathology, Karsner says: "The purpose of this book is to present the morphological alterations incident to disease, in the light of modern views as to their functional significance." In this he has succeeded. For example, somewhat more than a page each is given to a discussion of the functional disturbances accompanying obstruction of the coronary arteries; to functional disturbances incident to anæmia; etc. Numerous shorter paragraphs are entitled "pathological physiology" in which functional disturbances are discussed.

The conventional division into general and special pathology has been adopted. The results of the author's own investigations are manifest in the very full discussion of such subjects as infarction, obstruction of the coronary arteries, nephritis, etc. Some subjects which are ordinarily discussed at length in general pathology, in that section of this volume receive brief consideration. For example, œdema is given about a page in connection with the general subject of passive hyperæmia; while renal œdema is considered more fully in special pathology under nephritis.

The tabular arrangement of subject matter at the beginning of each chapter in general pathology gives to each topic its relative associations with the general subject of the chapter and will be helpful to the student in orienting himself. The bibliography is placed at the end of each chapter. While in no sense complete, the references have been well selected and are chiefly from journals published in English. The illustrations are, in general, very satisfactory. Figure 73, on page 191, is especially good, as it gives in perspective a reproduction of newly formed capillary loops in granulation tissue.

After a careful examination of this book one must agree with Dr. Simon Flexner in his introduction, that it "presents the broad subject of pathology, as now conceived and taught in this country and Europe, in a manner suitable for the medical and biological student as well as for the practitioner of medicine desiring to keep abreast with the ever enlarging subject of pathology." J. P. SIMONDS.

A BOOK embodying the Goulstonian Lectures given by Graham[5] in 1921, provides an admirably clear and concise summary of our present knowledge of carbohydrate metabolism. Part I describes the physiology of the sugar metabolism while Part II contains an account of the types of diabetes mellitus and of the treatment of the disease. A bibliography follows each chapter. The writer has adopted as the main principle of treatment fasting

[1] THE OPHTHALMIC YEAR BOOK. vol. xxii. Containing bibliographies, digests, and indexes of the literature of ophthalmology for the year 1925. Edited by William H. Crisp, with the collaboration of others. Menasha, Wisconsin: George Banta Publishing Company, 1926.

[2] THE LOST LEGION: THE STORY OF THE FIFTEEN HUNDRED AMERICAN DOCTORS WHO SERVED WITH THE B. E. F. IN THE GREAT WAR. By W. A. R. Chapin, M.D. Foreword by Franklin H. Martin, M.D., F.A.C.S. Springfield, Massachusetts: The Loring-Axtell Company, 1926.

[3] ANATOMIE DES NERFS CRANIENS ET RACHIDIENS ET DU SYSTÈME GRAVA SYMPATHIQUE CHEZ L'HOMME. vols. i and ii. By A. Hovelacque. Paris: Gaston Doin et Cie, 1927.

[4] HUMAN PATHOLOGY. A Textbook. By Howard T. Karsner. With an introduction by Simon Flexner, M.D. Philadelphia and London: J. B. Lippincott Company, 1926.

[5] THE PATHOLOGY AND TREATMENT OF DIABETES MELLITUS. By George Graham, M.A., M.D., F.R.C.P. 2d ed. London and New York: Oxford University Press, 1926.

blood sugar values within normal limits and a rise above this level only for short periods after meals. The Hagedorn-Jensen *micro* method of blood sugar estimation is used. Preliminary fast days are employed followed by a "ladder" diet. An appendix contains details of diets (weighed in ounces), lists of caloric values, and various chemical tests. This practical work should be of value to clinicians.

WALTER H. NADLER.

IN reviewing volumes i and ii of *Therapeutique chirurgicale*,[1] the reviewer wishes to recall what he said when reviewing volume iii, the first of the series.

"Lecène and Leriche discuss the surgical treatment of various conditions in very much the same manner that a consulting surgeon would talk over the case with the internist. The reader is presumed to have a general knowledge of semiology, physical diagnosis, and pathology and to be able to have established a diagnosis. The authors attempt to show the indications for surgery and the general lines along which the surgical treatment should be conducted."

Volumes i and ii, which complete the series, deal with surgical intervention exclusive of the abdomen which is considered in volume iii. The general construction and treatment of the subject is similar to that in the third volume. There are no illustrations, none being necessary.

The series is to be highly recommended to those physicians, almost irrespective of their specialties, who are willing to devote time to the more philosophical works.

The reviewer will not discuss his objections to some of the statements made, because the authors present frankly a compilation of their own work and they state the reasons which have led them to their conclusions. In general the opinions expressed by Lecène and Leriche are sane and conservative and in harmony with the best surgical judgment of the day.

RALPH B. BETTMAN.

[1] THÉRAPEUTIQUE CHIRURGICALE. vols. i and ii. By P. Lecène and R. Leriche. Paris: Masson et Cie, 1926.

BOOKS RECEIVED

Books received are acknowledged in this department, and such acknowledgment must be regarded as a sufficient return for the courtesy of the sender. Selections will be made for review in the interests of our readers and as space permits.

LA CHIRURGIA DEL SIMPATICO VISCERALE. By Prof. Mario Donati and Prof. Dino Vannucci. Rome: Società Tipografica A. Manuzio, 1926.

CHILD LIFE INVESTIGATIONS; A CLINICAL AND PATHOLOGICAL STUDY IN 1673 CASES OF DEAD-BIRTHS AND NEONATAL DEATHS. Compiled by Eardley L. Holland, M.D., F.R.C.S., F.R.C.P., and Janet E. Lane-Clayton, D.Sc., M.D., London: His Majesty's Stationery Office, 1926.

HANDBUCH DER UROLOGIE. Edited by A. v. Lichtenberg, F. Voelcker, and H. Wildbolz. vol. i. Allgemeine Urologie I. Berlin: Julius Springer, 1926.

PROCEEDINGS OF THE TWENTIETH ANNIVERSARY CONVENTION OF THE ASSOCIATION OF LIFE INSURANCE PRESIDENTS. Held in the Hotel Astor. New York, N. Y. December 9 and 10, 1926.

ANNUAL REPORT OF THE SURGEON GENERAL OF THE PUBLIC HEALTH SERVICE OF THE UNITED STATES. For the Fiscal Year 1926. Washington: Government Printing Office, 1926.

THE MEDICAL DEPARTMENT OF THE UNITED STATES ARMY IN THE WORLD WAR. vol. vi.—Sanitation in the United States. By Col. Weston P. Chamberlain, M.C. Prepared under the direction of Maj. Gen. M. W. Ireland. Washington: Government Printing Office, 1926.

A STATISTICAL SURVEY OF THREE THOUSAND AUTOPSIES. From the Department of Pathology of the Stanford University Medical School. By William Ophüls, M.D. California: Stanford University Press, 1926.

CONTRIBUTION À L'ÉTUDE DES TROUBLES CARDIO-VASCULAIRES DANS LES ANÉVRYSMES ARTÉRIO-VEINEUX TRAUMATIQUES. By Docteur Edouard Desjardins. Paris: Louis Arnette, 1926.

L'ANNÉE OBSTÉTRICALE (TRAVAUX DE 1924). By H. Vignes and J. Dauphin. Paris: Masson et Cie, 1926.

DE LA CONTRACTION UTÉRINE; ET DES DYSCINÉSIES CORRÉLATIVES. By L. A. Demelin. Paris: Gaston Doin & Cie, 1927.

TRANSFUSION OF BLOOD. By Henry M. Feinblatt, M.D. New York: The Macmillan Company, 1926.

GENERAL INDEX. Transactions of the American Gynecological Society. vols. i to l (1876–1925) inclusive. Philadelphia: William J. Dornan, 1926.

SURGICAL ANATOMY OF THE HUMAN BODY. By John B. Deaver, M.D., Sc.D., LL.D., F.A.C.S. 2d ed. in three volumes thoroughly revised and rearranged. vol. ii—Upper Extremities, Neck, Shoulders, Back, Lower Extremities. Philadelphia: P. Blakiston's & Son, 1926.

AMERICAN COLLEGE OF SURGEONS

SURGERY AND THE INTERNATIONAL SPIRIT[1]

By RUDOLPH MATAS, M.D., F.A.C.S., New Orleans, Louisiana

FOR the second time in the 14 years of its existence, the American College of Surgeons meets today in the heart of the Dominion of Canada. Once again it celebrates its annual convocation and clinical congress within the historic and hospitable metropolis of British North America. It was in Montreal, 6 years ago, that we first met in commemoration of the union which since the very day of our foundation fused into a common fellowship the professional ideals and interests of the surgeons of the United States and Canada.

This was in 1920. Two years had passed since the volcanic fires of the World War had been extinguished, but the souls of men were still stirred and kept aglow by the memory of humanity's afflictions, and still felt the exaltation of its triumphs and heroisms. The time was opportune; the trysting place well chosen, for a meeting between the surgeons of America and of the British Empire. Brethren in a common cause, they had stood side by side with their allies striving to stem the tide of death, blood, and destruction which deluged the shell scarred fields of Europe. It was a glorious gesture of British surgery when to greet us on this occasion she sent her chosen representatives across the seas with a symbolic gift that spoke for the unity of the English peoples, their kinship in blood, language, and traditions, pledging the affections of the Mother country to the mission and ideals to which we of America had vowed our organization.

It was thus that the great Mace, now so proudly held at the head of our annual processionals, was presented to us by the consulting surgeons of the British armies at the Front. It was indeed a glorious inspiration which led the standard bearers of British Surgery to design this beautiful gift as a massive and enduring testimonial of the ties that bind the English speaking nations in common brotherhood. It is not so long ago that this inspiring ceremony was enacted in this very city. It is still fresh in the memory of many who witnessed it. But several generations of new Fellows have since been added to our roll call and there are still others now waiting for their investiture by the College, some of whom may not be familiar with the history of the great Mace and of the pledges that were exchanged at the time of its presentation.

Quoting the closing sentence of the address delivered by that inspired spokesman of British Surgery, Sir Berkley Moynihan, now president of the Royal College of Surgeons of England, will suffice to prove that his message is not only worthy of repetition but peculiarly fitting upon this occasion, for the sentiments therein expressed remain uppermost in our minds today and are warmly harbored in our breasts.

"In our desire to perpetuate a remembrance of duty done together, we, the consulting surgeons of the British armies, ask the College of Surgeons of America, meeting in this great dominion, to accept this Mace. We pray that you may regard it as a symbol of our union in the harsh days of trial; as a pledge of our devotion to the same imperishable ideals; as a witness to our unfaltering and unchanging hope that the members of our profession in the two lands shall be joined in brotherhood, forever in the service of mankind."

In reply, our president, the honored and beloved Dr. Armstrong of McGill and of the Victoria Hospital, himself a Canadian and, through his office, the living symbol of the union of the Canadian and American professions—standing in this great hall with the Dominion of Canada and the United States as a background to a magnificent panorama of international comradeship—accepted the great Mace, as a symbol of the zeal and enthusiasm in our art, which, arising in the old world, had spread to the new world. "We shall endeavor," he said, "to keep on this western hemisphere the sacred flame of Science burning not less brightly than did our forebears in Great Britain. It will remain with us an emblem of unity, a work of art and a remembrance of the great effort of the two English speaking nations, to give truth, liberty, and justice to all people and to all nations. The fire of Science represented in this gift welds another link in the chains that

[1] Address of the retiring President, Clinical Congress of the American College of Surgeons, Montreal, October 25, 1926.

bind us forever in united effort to promote the highest possible standards of surgery as well as peace and good will among men."

Such is the story of the great Mace and we are here again, in Montreal, happy to renew the pledges of 1920 and to stand by all, and everything, that the great Mace means to us as a symbol of the solidarity of our guild and of the limitless domain of our science and of our art when engaged in the service of mankind.

In harmony with the spirit of international cooperation which from the very foundation of the College has united our aims and our purposes with those of the Royal Colleges of Surgeons of the United Kingdom, and apart from the special significance which the presentation of the great Mace attached to our first Convocation in Montreal, other thoughts gather about our present visit to this cosmopolitan metropolis which invest it with delightful associations and anticipations.

The admirable report of Dr. Bazin, chairman of the local committee of arrangements, just read, attests the zeal and good will which the profession of Montreal has put into the task of instructing and entertaining us. The doors of all the hospitals and institutions, irrespective of denomination, have opened wide to receive our Fellows. A full program of clinics, surgical operations and other technical demonstrations has been arranged. It bids fair to rival and even surpass the brilliant record of 1920, in excellence of arrangements and in wealth and variety of clinical material that will be exhibited and discussed by the eminent surgeons who are at the head of these institutions. These distinguished teachers will contribute to the professional and scientific profit of this Congress by the lessons gathered from their learning and the witness of that skill which has made them famous.

In addition to our gratefulness for the arduous labors of the local profession, we are deeply appreciative of the presence of the distinguished guests from the Dominion, notably Sir Arthur William Currie, principal of McGill University, of Prof. Lotbinière-Harwood, the Dean of the Medical Faculty of Montreal University, and the eminent surgeons from the United Kingdom, and from Italy, and from far away New Zealand and elsewhere, who have traveled a long way over land and sea to grace this occasion and to generously share with us the bounty of their science, their wisdom, and their art.

It is with a deep sense of appreciation that we see here assembled so many of our own Fellows and associates, many of whom reside in the furthermost states of the Dominion and of the American Union; and others from our island possessions, and again others from the still more distant countries of Central and South America; all these have come to attest their loyalty to the College and their devotion to its principles. All may be assured that their presence adds dignity to this occasion and that their participation in our exercises adds to the value of our Congress as a confirmation of its international character and of the unity of surgery in its humanitarian purpose. Guests, Colleagues, and Fellows, I again thank you most heartily in the name of the College and extend the warm hand of Fellowship.

Without presuming to anticipate the greetings that will accentuate the cordial welcome assured our distinguished guests when individually announced in the more formal introduction that is to follow, I cannot withhold an expression of special gratification as I recognize in this eminent company the regius professors of surgery of the Universities of Edinburgh and of Glasgow.

It is particularly appropriate that this should happen at a congress of American surgeons, held in the great capital of the Canadian Commonwealth—in a city and a province where the map is dotted all over with signs that point to the monuments erected to commerce, industry, and education, by the enterprise, energy and genius of Scotland's sons and their Canadian descendants, where Scottish medicine and surgery have been transplanted and flourish with wonderful fertility, and where the heather and thistle seem to grow apace with the maple and the fleur-de-lis—at least in the hearts of men. It is here that we admire the monumental height of McGill, casting its beacon light over a continent in radiant proclamation of the intellectual strength, the solidity, the stability of Scottish tradition and culture.

Agreeable as it would be to discuss the parental relations of the Scottish medical schools to the origin and development of medical education and medical institutions of "Greater Britain," including in this designation the United States, as did Osler, so appropriately, 30 years ago, this task has been done too often and too well to permit me more than an allusion to the space occupied by the universities of *Antiqua Scotia*, and particularly Edinburgh, in the medical history of America, where they are held in veneration not only as repositories of great historic shrines—shrines that are hallowed by noble traditions and memories of a glorious Past—but as fountains of living waters which continuously flow as a spar-

kling stream of gathered knowledge and fresh discovery. Need I invoke the names of the Munros (primus, secundus, et tertius), the Hunters (William and John), the Bells (Benjamin, John, and Charles), of Lizars, Liston, Ferguson, Simpson, and Syme; and of the later generation, Keith, Chiene, Annandale, Ogston, Macewen, Alexis Thompson, Stiles, and now Fraser, Wilkie, and Young, to an audience of Surgeons who are preparing to celebrate, with a scientific festival, the approaching anniversary of the one hundredth birthday of Joseph Lister—*Lord* Lister, if you will, not only Lister of Glasgow, Edinburgh, and London, but Lord Lister of the world!

Is it not fitting that the successors of the immortal Master, the present occupants of the chairs of surgery which he successively occupied for 9 years in Glasgow, for 8 years in Edinburgh, who have so worthily maintained the prestige and renown of his inheritance, should be here with us today, to give luster to our proceedings and to unite their efforts with ours in rendering homage to the memory of their illustrious predecessor—Lister, not only the greatest surgeon of his age, but the greatest benefactor that the science of surgery has given to mankind!

LORD LISTER IN CANADA

It was in 1897 that the medical profession of Canada was roused to a high pitch of enthusiasm by the visit of Lord Lister. He had come to Toronto to preside over the British association for the advancement of science, and to participate in the annual meeting of the British Medical Association which was held in Montreal, for the first time in the history of these two most important associations.

The presence of Lord Lister in Canada was the signal for a continuous ovation which, beginning in Toronto, reached its climax in Montreal and never ceased its pean of praise until the day of his departure for England.

The proceedings of the association in Montreal, as recorded in the official journal, are particularly interesting and evocative of many retrospective reflections to the men of the profession who can go back these well-nigh 30 years that medicine has traveled in this momentous period of her history. I venture to say there are not many here who were active participants at that epochal meeting. The outstanding figures of that splendid drama have nearly all passed on to join the great majority, but there are others who were then in their prime and busy, building their great reputations—Shepard, Armstrong, Primrose, Franklin Martin, distinguished in our guild, and others whose names I cannot recall at this moment, but whom I am happy to see here as in living testimony of their strength, vigor, and usefulness. Theirs is the enviable privilege denied their juniors. They saw the great apostle and heard his spoken word!

Lord Lister had just rounded his seventieth birthday, but was still active, vigorous, animated, and ready to meet the endless calls that were made upon him as the central and most courted figure in this vast gathering of the crowned heads of the profession. Sir Thomas Roddick, president of the association and one of Lister's most attached pupils, inaugurated the proceedings by an admirable address, in which he paid a most feeling and fitting tribute to his great teacher. The Medico-Chirurgical Society of Montreal gave Lord Lister a banquet and presented him with an illuminated address. McGill University conferred upon him the honorary degree of LL.D., in company with Professor Richet, the eminent physiologist who had come to the meeting as the delegate of the French Republic and of the French Academy, and, in addition to a group of distinguished men whose names stand for all that is highest and best in our profession.

SIR THOMAS RODDICK

Dr. Roddick, later Sir Thomas Roddick, as he was knighted in 1914, was the first colonial president of the first overseas meeting of the British Medical Association. In 1897, when he presided at this meeting, he was at the zenith of his reputation as the leader of the Canadian profession. That of which he was most proud, was his early association with Lister and the leading part which he had played in introducing Listerism into Canada.

As a surgeon, teacher, dean, administrator, and medical statesman he left at his death, in his seventy-seventh year, on February 28, 1923, a record of extraordinary usefulness in the service of his people and of his profession. The American College of Surgeons honored itself by conferring on him its honorary fellowship in 1914, 9 years before his death.

PROFESSOR J. GEORGE ADAMI

In going over the long list of the eminent men who contributed to the success of the Montreal meeting in 1897 and who are identified with the progress of medicine in Canada, my attention is arrested by the name of Professor Adami, at that time Strathcona professor of physiology and bacteriology at McGill. His death, which occurred in Liverpool, on August 26 of the current year,

has brought to mind the most memorable period of his life when he was a teacher in Montreal. He was then 32 years of age. An enviable reputation as a scientific investigator of unusual ability in pathology had preceded his coming to McGill. He had a remarkable clearness of vision and felicity of expression in the interpretation of obscure and complicated pathological and philosophical problems. The surgeons of America owe him a large debt of gratitude for familiarizing them with the modern concepts of inflammation as a defensive reaction based upon Metchnikoff's then all-absorbing researches on phagocytosis—a marvelous conception which Adami developed and invested with all the attributes of a fascinating philosophical doctrine. His article on inflammation in Albutt's and Rolleston's *System of Medicine* was recognized as an outstanding feature of that great compendium. The principles of pathology which appeared in 1909, and later his *Textbook of Pathology* in which he was assisted by his colleague, McCrea, of McGill University, did more to enlighten the American students of the nineties and to create an interest in the study of pathology than any other textbook published at that time.

It was my privilege to meet him when he came to New Orleans, April 24, 1912, where he read a paper on "Sensation and Pain" while a guest of the Louisiana State Medical Society. The charm of his conversation, breadth of view, and elevated thought, left with me, as with all of us, an ineffaceable impression.

I have merely touched upon this outstanding figure of Canadian medicine to express my deep appreciation of his personal worth and scientific merit. I feel grateful to his illuminating writings for the ray of light they brought me at a time when I was groping, like so many others of my time, to find my way in the darkness of new and conflicting problems. In Montreal, the seat of his greatest scientific triumphs, I feel that I would not be just to him or myself without dropping this little thought—a tiny flower grown in the garden of memory—in token of admiring appreciation.

SIR WILLIAM OSLER

The general address on medicine entitled "British Medicine in Greater Britain" was delivered by Osler and was one of the memorable features of the Montreal meeting in 1897. In this he reviewed with his characteristic felicity, brilliancy, scholarship, and human sympathy the "factors which have moulded the profession in the English speaking lands—beyond the narrow seas of British medicine in Greater Britain." This address was a masterpiece of literary composition, not only in that it sparkled with gems of classic erudition, but in that it excelled in its large vision, comprehensiveness and thorough mastery of the field surveyed. His humanistic conclusions are largely tinctured with Osler's British idealism, and the address as a whole leaves the impression of a vast and varied panorama which has been transferred to a colorful canvas painted by a master hand. It is an intensely inspiring document, every bit worthy of the enthusiastic acclaim with which it was received. To all who knew that incomparable humanist and apostle of Hippocratic medicine, who have been inspired by his magnetic personality and have been nourished intellectually by his writings, the perusal of his recent biography by Cushing, is enthralling. This extraordinary narrative is so vivid and photographically true to the great life that it portrays, that it leaves one with the impression of a resurrection, a living speaking reincarnation of a life restored with all its living charm and spiritual loveliness. In this performance surgery may claim for one of its greatest masters, the miraculous achievement of bringing back to life one of the greatest and best loved of physicians—an operation performed not with the point of a knife, but with the point of a pen; so that we may well say, in paraphrasing an ancient legend, "the pen is mightier than the scalpel."

As stated by one of Osler's most distinguished friends and judicious commentators on his life (W. W. Welch): "Osler often applied to himself Gibbon's admission that he had drawn a high prize in the lottery of life," and surely his career also represents a successful experiment in the great art of living. One cannot fail to be impressed with the almost perfect adaptation of his talents and temperament to the accidents and circumstances of life, and not less to the dextrous ministrations of these diverse external events to the ordinary development and fulfillment of purposes and ideals formed in youth and early manhood. But rarely has Alfred de Vigny's conception of a great life been more fully realized: "*Qu'est ce qu'une grande vie? Une pensée de la jeunesse executée par l'âge mûr.*" (What is a great life? The dreams of youth realized in maturity.) Osler was fortunate in many ways, but fortune was never more gracious in life than she was in death, when she placed this imperishable record of his life as a wreath of immortelles upon his grave.

PROFESSOR CHARLES RICHET

Professor Charles Richet, the distinguished physiologist, attended the Montreal meeting (1897) as a delegate of the French Republic and of

the French Academy. He delivered a brilliant address in French at Laval University on the "Work of Pasteur and the modern conception of Medicine." Pasteur had ended his labors for all time (in September, 1895), and his remains had been lying at rest for 2 years in the Memorial Chapel of the Pasteur Institute. This meeting of the British Association at Montreal, in a French Canadian province, made it singularly appropriate that so eminent a representative of French science and a pupil of Pasteur, should come to pay a tribute to his illustrious master. It was most fitting that on this occasion the names of Pasteur and Lister should be linked together and encircled with the same halo of glory in the presence of the two nationalities that gave them birth. It was a fine opportunity to extol the superb merits of one without detriment to the achievements of the other; and, in stressing the revolution that the scientific genius of Pasteur had wrought upon medical sciences, Richet gave just credit to Lister as a reformer and pioneer who had seen the light and illumined with it the dark shadows that for centuries had enveloped surgery, and had thereby lifted it from a rank empiricism into a glowing, vivifying and all-pervading science. "It seems to us now," he said, "that the medical profession before 1868 was blindfolded and that its blindness was almost criminal. These are *now* (1897) no more than historic memories. A sad story, doubtless, but one at which we must look calmly in order to understand what Science had done and can do for Medicine. Left to their own resources, practitioners of Surgery, during long centuries, could do nothing against suppuration, the deadly infections of wounds, erysipelas, hospital gangrene, pyæmia, septicæmia, puerperal infection; but basing itself upon Science, Surgery had triumphed by preventing these odious diseases, and relegating them to the past."

In speaking of the interdependence of medicine and experimental science, he closed with this fine thought: "From this unceasing collaboration, progress will be born, but it is necessary that men of science and physicians should be animated by these two governing sentiments: *faith in science and love of man.*"

PASTEUR AND LISTER

Professor Richet's lecture revives the historic episode which occurred at the Sorbonne, where an international gathering of the greatest representatives of the scientific world had assembled to celebrate the seventieth anniversary of Pasteur's birth (December 22, 1892). It was a dramatic and inspiring moment when Lord Lister, bearing the congratulations of the Royal Societies of England and Scotland, rose, drew near Pasteur and gave him a fraternal embrace. It was a stirring moment; a spectacle never to be forgotten! This memorable scene has been faithfully preserved by a matchless artist (Rixens) on canvas that no lover of his profession can see without being moved by its grandeur and significance. For the embrace of these two men was like a living picture of the brotherly unity of Science and Medicine in the relief of mankind.

Some paragraphs of Pasteur's feeling address on that celebrated occasion are well worth recalling. In thanking the delegates who had brought him congratulations from all parts of the civilized world, he said "You bring me the deepest joy which a man can feel who believes invincibly that Science and Peace will triumph over ignorance and war, that men will unite not to destroy, but to build up and that the future will belong to those who have done most for suffering humanity, and here I appeal to you, my dear Lister and to you all, illustrious representatives of the sciences of medicine and surgery."

Fortunately for Pasteur and Lister they were both spared the agony of 1914–1918, and the *angor cordis* of witnessing their hopes and humanistic illusions vanish in the smoke of the funeral pyres of that fearful hecatomb.

"Pyres in the night, in the night!
In the plain, on the hill.
No volleys for their last rite,
We need our powder—to kill.
High on their golden bed,
Pile up the dead!

"Pyres in the night, in the night!
Torches, piercing the gloom!
Look! How the sparks take flight!
Stars, stars, make room!

"Smoke that was bone and blood!
Hark! the deep roar.
It is the souls telling God
The glory of WAR!

* * *

If I have evoked the splendid names of Lister and Pasteur and have dwelt at length on the events and personalities that have long since passed into the realm of history, it is not to indulge merely in agreeable recollections that might contribute to the amenities of this occasion. No! It is for a more specific purpose that I have appealed to the Past to illumine the Present.

The proximity of the Listerian centennial and the fact that we are meeting in the heart of the Canadian Dominion and in this cosmopolitan city, where two nationalities live together, speak different languages and pursue their ideals, political and national preferences, in perfect agreement as to their federated rights; where all the elements of history, romance, and tradition have mingled to inspire the international spirit—these are the considerations that have prompted me to profit by this opportunity to give expression to a few thoughts and sentiments that are in keeping with one of the chief purposes of this College, namely, *the promotion of international co-operation and comradeship among the surgeons of the world in the pursuit of the same humanitariau ideals.*

Pasteur, the father of modern scientific medicine, and Lister, the father of modern scientific surgery, are inseparably linked, in the eyes of the world, as the two greatest benefactors that the nineteenth century gave to suffering mankind.

In this humanistic sense these two personalities stand before the world as the embodiment of the spirit of internationalism which, in medicine, as in the pure sciences and liberal arts, is only an expression of the kinship and friendship of mankind. If I have evoked these great names it is only to bring into relief the cosmopolitan character of the surgeon in his humanistic and humane functions which are inseparable from his professional mission in the social body. By humanistic, I mean to differentiate between the duties of the surgeon that he owes to the individual and to his own particular community, and those that he owes to the collectivity—in a word to humanity—without any of the limitations imposed by geographical, social, racial, religious, or political frontiers.

The progress of surgery and the universal acceptance of the principles of surgical cleanliness laid down by Lister tend to give the surgeon a more objective evidence of his world citizenship than in any previous age. Dressed in white, immaculate, gloved, capped, masked, he officiates during the better part of his day in the operating room,—a veritable sanctuary, in which, by heat sterilization, the most refined cleanliness and purification prevails. To the visitor in any of the surgical clinics of the world, this uniformity is almost monotonous and is so lacking in individuality that it challenges the most expert observer to discover the nationality of the operator. Whether in Tokio, New York, Paris, Cape Town, Calcutta, it matters not where, the surgeon, to outward appearance, is always the same,—the unit of a profession that claims no nationality when in action, and only recognizes the world as its birthplace.

In War, as in Peace, the rôle of the surgeon as a peace-maker has been recognized from Homeric days to the Present. His altruistic creed, learned in the Æsculapian temples of Cos and Epidaurus, is truly an heirloom which he has held sacred, for the good of mankind, throughout the ages. The doctor is a pacifist by the very nature of his calling. He is the friend of all classes, through his ministrations, which apply equally to the rich and to the poor.

In the bitter clash of political factions one may be both the physician and intimate friend of the combatants. The disputes between labor and capital do not prevent the doctor from being trusted as the friend of the members of each group who forget, in relation to him, their class consciousness.

> "When civic strife ran fierce and high,
> His was the storm-assuaging speech
> That made the wordy tumult die
> And linked the neighbors each to each."

Cabot, in his admirable book on the *Training and Rewards of the Physician,* tells that, in one of the labor wars of Colorado, when the strikers were put in the "bull-pen," the only persons who passed freely from the outside to the inside of the stockade were the doctors. In the World War, it was only the surgeons and the nurses who could work alike for their allies or their enemies. The valuation placed upon the doctor's knowledge has often not only protected him, but others, from violence and death, at the hands of foes. To kill the doctor would sometimes mean suicide for his enemies, who depend upon his knowledge to save them from the effects of pestilence and of wounds, if we are to judge by facts recorded in history. The extraordinary episode in Ambroise Paré's life in which he relates how he was spared on St. Bartholomew's Day, in the massacre of the Huguenots, his coreligionists, is one of the most remarkable events in his extraordinarily varied career. King Charles IX, who amused himself during the massacre by firing from a window of his palace at the flying victims of his persecution, kept crying out: "Kill! kill!", with never a wish to save one of them; and yet he would not allow a hair of Master Ambroise Paré's head to be touched by his vindictive minions! On the eve of the massacre he sent for Paré that he might hide him in his own palace, commanding him not to stir out of the chamber next his. He said that it was not reasonable that one who was worth a whole world of men should be murdered; and he, Charles, would not urge

Paré to change his religion any more than he would urge his old nurse to change hers.

The peace-making virtues of the surgeon and physician have been prized by kings, conquerors, statesmen, explorers, and by the great colonizing nations of the world. Often they appear in history as strong allies of the Flag and of the Cross in the conciliation of conquered and unsubdued races. In the propagation of the faith as well as in the political subjection of heathen or savage races, the medical man has stood by the conqueror, explorer, and the missionary, not only as a healer of wounds, but also as a pacifier and soother of other not purely physical ills and woes.

The most successful French colonial administrators of recent times, Paul Bert, Gallieni, Mangin, Lyautey, thoroughly understood how to utilize the pacifying power of medicine and surgery in propitiating the good will of their savage or rebellious peoples. Marshal Lyautey's success in Morocco was largely due to the early establishment of hospital centers, with free surgical and medical clinics, throughout the protectorate. In this his wife gave him great aid by establishing schools and homes for trained nurses. Lyautey said, "In pacifying and conciliating the most unruly tribes, one good surgeon with a half dozen nurses was worth more than a whole regiment of soldiers." The same methods have been applied by British, German, Dutch, and other modern and enlightened colonial powers.

The rise of industrialism and mass production in manufacture, by great private corporations in this and other countries, has brought to the surface in recent years, and especially since the world war, new problems which involve the preservation and protection of the health of the millions of workers who are engaged in trades and industries. A new era in social medicine and surgery has arisen which has added enormously to the demand for international co-operation. A new literature has sprung up within the last few years in which such titles as "Industrial Surgery," "Prophylactic Surgery," "Railroad Surgery," "Surgery of the Reconstruction and Rehabilitation of the Disabled from Accident and Injury," and other varieties of surgical service, have come into prominence. Today, the problems of compensation for injury among the employed working classes have opened new fields for enterprising insurance companies, and have created new opportunities for the younger generations of surgeons.

The effort of the great American philanthropists to benefit humanity at large through the instrumentality of medical education, by the endowment of medical schools, by medical research, and international sanitation, is one of the most notable developments of the present age. In this work the Rockefeller and Carnegie Foundations tower to a great height. In the distribution and application of their wealth they have given to the world an example of statesmanship and wisdom which in generous intent and achievement has no parallel in the world's history. These and other benefactions, which American philanthropists are bestowing upon the world, through the agency of medical education and sanitary science, are only a few typical examples of the world gifts that have resulted from American idealism.

President Coolidge recently said (October 5, 1926), in commenting upon the humanitarian service of the American Red Cross in the Tokio earthquake and during the more recent devastating hurricane in Florida: "These manifestations of international amity and sympathy offer the most complete demonstration of the fact that our people in their capacity to accumulate property and wealth are moved by a righteous purpose," adding, "their success has not turned to greed, avarice, or selfishness, but has been productive of generosity, benevolence and charity—not to benefit America alone, but all the people of the earth."

There seems to be no limit to the possibilities of scientific medicine and surgery to which philanthropists are turning their minds as the hope of humanity. Philosophers see, as if in some far-off vision, a science which may come, as in the prophetic words of the son of Sirach: "To bring Peace over earth."

To illustrate the esteem in which the surgeon is held by all classes of society, and the leveling effect of his professional worth upon "class consciousness" and "class barriers," Dr. Tuffier, the distinguished French surgeon and one of our honorary Fellows, quite recently related the following interesting experience: "It was in the midwinter of 1916, I was at the Front where we were in the thick of the fray. Suddenly I was called by a Belgian telegram to the bedside of my friend, Depage. He had been infected in the course of an autopsy. The infection had spread and was threatening his life or at least to mutilate him. I left the Argonne full of anxiety on his account, to arrive at LaPanne, that narrow streak of the Belgian beach which had been saved by Depage out of the wreckage of the German invasion, and which is so well remembered by all the Allied surgeons who flocked to it as a refuge of science and a home for the Allied wounded during the hours of Belgium's greatest affliction. Upon

entering the sick chamber, I beheld an unforgettable scene. My illustrious colleague was lying prostrated in bed and overwhelmed by a violent septic fever. Next to him stood a nurse, calm and thoughtful but whose expression denoted a profound anxiety. As she turned to me, I recognized her Majesty, the Queen of the Belgians! What better praise could be given to surgery than this humble and touching tribute of a noble Queen to a surgeon, a democrat by birth, but a king in his own profession?"

* * *

In referring so often and so insistently to internationalism as one of the dominant traits of our professional character, I wish to be understood as not advocating that cosmopolitanism with which it is so often confused. The cosmopolitanism of the philosophers and rationalists of the eighteenth century, which is allied to socialism and communism, is not to be confused with the internationalism that I have in mind. That cosmopolitanism carried with it a decrying of local and national distinctions and of patriotism. The unit of its ideal world state was the individual or a social class, and not the nationality or the national state.

Internationalism, as I understand it, presupposes a prime loyalty of the individual to his national state, a cherishing by him of his national language and his national traditions, a lively patriotism within him. The internationalist aims to build his world state with national blocks—as we see so well exemplified in the Swiss Republic, in the Union of South Africa, and here in your own Canada, where side by side with the French nationalism of Quebec and the British nationalism of, say, Ontario, exists a common Canadian patriotism. To urge the propagation of internationalism is not to deny patriotism; rather, it is to purify and exalt it through patriotism. Patriotism and love of one's country is a peculiar natural and ennobling expression of man's primitive sentiments of loyalty (Haynes).

In one of the most inspiring addresses of Sir William Osler, delivered in this very city, 24 years ago ("Chauvinism in Medicine"), that splendid humanist, after delivering a most eloquent invective against the evils of nationalism, said: "Breathes there a man with his soul so dead that it does not glow at the thought of what the men of his blood have done and suffered to make his country what it is? There is room, plenty of room for proper pride of land and birth. What I inveigh against is the present spirit of intolerance, conceived in distrust and bred in ignorance, that makes the mental attitude perennially antagonistic, even bitterly antagonistic, to everything foreign; that subordinates everywhere the race to the nation, forgetting the higher claims of human brotherhood."

The function of internationalism in medicine and surgery is to favor the exchange of ideas between medical men of different nationalities for the good of all. This, as we have said, is not incompatible with true patriotism which urges the production of what is best in the race and in the nation, not for purely selfish nationalistic consumption but for the universal good.

This concept of scientific patriotism is in perfect harmony with the humanizing character of modern, intellectual internationalism. The spur of nationalism is, or should be, used to speed the progress of the world, without inflicting on humanity any of the gashes or the pernicious and destructive exhibitions of a narrow, egotistic, and exclusive nationalism. If we understand patriotism in surgery, as it is known in the sciences and arts—as a pride in the glory of the greatest achievement for one's own country and race in the interest of a common profession and of a common humanity—it behooves us to nourish and cultivate this type of patriotic sentiment as a national asset of the greatest value. From this point of view, American surgeons have shown no lack of patriotism, and the same spirit that led the American people to put in motion over four millions of men and women and to actually sacrifice over half a million of its best manhood in the cause of human freedom, can be trusted to enlist its best energies to accomplish for humanity in Peace all that it did in War! The American College of Surgeons by virtue of its fusion with Canada, and through the extension of its fellowship to the Latin-American countries of Central and South America, is truly an international organization.

Its ambition is to make the American surgeon worthy of the honor of his title, worthy of the trust reposed upon him by his people, and worthy of the respect and confidence of his professional fellows throughout the world.

In closing, I realize that I have consumed much of your time and probably more of your patience, in what may appear to many of you a purely academic dissertation. It is difficult, if not impossible, in speaking of professional harmony, fraternalism, and of international amity, to avoid the commonplaces or repetitions of sentiments that are now so worn by usage that they have become demoded through their very antiquity.

While freely confessing all this, I, none the less, venture upon another transgression by holding

before you one of the oldest gems of antique thought which, in spite of the twenty-one centuries that it has been circulating around the world, retains all the resplendent humanistic significance that it possessed when it first emanated from the mind of a poet and philosopher (Terence) who, moved by the promptings of the international spirit, first gave it expression: "Homo sum, nil humanum a me alienum puto" (I am a man and nothing human can be foreign to me), which I would adapt to this occasion by saying: I am a surgeon and nothing human can be foreign to me.

To the younger men, here present, whose idealism is still aflame and has not yet begun to flicker in the gusts of Time, I commend this ancient legacy as a motto worthy of a profession dedicated to the service of humanity.

* * *

And now that my task is done, allow me, my dear Fellows, to renew the expression of my grateful appreciation of the signal honor conferred upon me when elevated to the presidency of this College one year ago.

It has been a great privilege to have been allowed to watch at close range the working of the machinery which is moving this institution in its onward march to the fulfillment of its purposes, its aims, and its destinies. Though relieved of all the drudgery of its administration, and a very large measure of its executive functions, by your Executive Committee, by the co-operation of the distinguished members of the Board of Regents and by the sleepless watchfulness of our Director General, the presidency of this College is not altogether free from cares and responsibilities. The dignity of the office and the numerous calls that come from every quarter of the compass to represent the College at medical meetings throughout the country, add no little weight to the gilded mantle that rests upon the presidential shoulders. The greatest satisfaction that I experience at the close of my incumbency lies in the unquestionable evidence of the progress accomplished in the 12 months that we have traveled together.

The dedication and inauguration of the Murphy Memorial to the uses and purposes of the College, celebrated last June with becoming dignity and solemnity, mark an event of transcendent importance to the College. The benefits that will accrue from the acquisition of this wonderfully beautiful and inspiring building, cannot be exaggerated. The Murphy Memorial will stand for many years to come,—I dare not say *ages*, as there is nothing fixed or limited in the ambitions and ever expanding horizon of our profession, or of this enterprising country of ours—as a towering center of the organized activities of the surgical profession resident in the Western hemisphere.

We must also recognize the fact that this noble edifice, erected largely by public subscription in memory of the services to humanity rendered by one of the greatest members of our guild, marks an epoch in the relations of the medical profession and the public. To quote a sentiment expressed at the dedication: "The Murphy Memorial testifies in mute but unmistakable terms that the soul of surgery has found its place in the heart of humanity."

During the past 12 months our Fellowship has very appreciably increased. The sectional meetings are steadily increasing in value and popularity. The program of hospital standardization has expanded beyond the shores of America to engage in international service, as is fully attested by the admirable report of the Director of the Hospital Activities, recently returned from a survey of the hospitals of New Zealand and Australia.

I need not refer to the many evidences of the progress in hospital and professional welfare that the College can legitimately claim to its credit in the course of last year's advance, as these will be made the subject of a detailed report by our Director General.

I will, therefore, go no further in these remarks which have for their chief object to express gratification at the work done and my personal thankfulness to our distinguished founder and general director, Dr. Martin, and his associates, for their invaluable and sympathetic co-operation.

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And now, a last word, that is to express my delight in transferring the insignia and prerogatives of my office to a successor who so superlatively meets the requirements of this high office and of this particular occasion. A distinguished surgeon, eminent in his chosen specialty, renowned teacher of gynecology at McGill and gynecologist to the Victoria Hospital, a native of Canada and a life resident of Montreal—he is honored at home and abroad. A charter fellow of the College, a close student of its organization and purpose, a brilliant contributor to its history and a faithful collaborator in its enterprises, a cultured and accomplished gentleman—he has endeared himself to his associates and Fellows, and is pre-eminently fitted to symbolize the international spirit that animates this College and to tighten the ties of kinship and affection that bind us to the surgeons of Canada.

I have the honor to present Dr. Walter W. Chipman, President of the American College of Surgeons.